NOAA FISHERIES
NATIONAL MARINE FISHERIES SERVICE

Authorizations and Permits for Protected Species (APPS)

File #: 20571
Title: Reintroduction of Spring-run Chinook Salmon t

Applicant Information

Affiliation: US Fish and Wildlife Service, Pacific Southwest Region
Address: 2800 Cottage Way
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Project Information

File Number: 20571

Application Status: **Application Complete - Issued**

Project Title: Reintroduction of Spring-run Chinook Salmon to the San Joaquin River, from the Merced confluence to Friant Dam.

Project Status: New

Previous Federal or State Permit: 14868, 17781

Permit Requested:
- ESA Section 10(a)(1)(A) permit (Salmonid hatchery)

Where will activities occur? California (including offshore waters)

Research Timeframe: **Start:** 09/10/2018 **End:** 12/31/2023

Sampling Season/Project Duration: The USFWS is requesting this permit be issued for a period of 5 years. Activities may vary depending upon conditions and SJRRP needs, but are anticipated to occur annually as follows:
- Eggs and juveniles will be collected from source stocks September-May.
- Juveniles will be released into the San Joaquin River intermittently October-April.
- Adult releases into the San Joaquin River will take place intermittently February-October.
- Returning adults (for broodstock or transport) would be collected January-October.
- Acoustic tracking surveys would occur year-round.
- Snorkel surveys would occur January-October.
- Spawning and carcass surveys would occur August-December.
- Transport and handling of collected individuals will occur year-round as needed.
- Spawning, egg-incubation, juvenile rearing, and holding at the Interim Facility, SCARF, or SIRF year-round.
- Redd grates and emergence trapping would occur September-March.

Project Description

Purpose: The U. S. Fish and Wildlife Service (USFWS), under the auspices of the San Joaquin River Restoration n Program (SJRRP), is requesting authorization for take activities related to the reintroduction of salmonids to the San Joaquin River (SJR). This reintroduction is the result of the Stipulation of Settlement (Settlement) in NRDC, et al. vs. Rogers, et al., approved by the Settling Parties in October 2006. The USFWS has previously conducted reintroduction activities under 10(a) (1) (A) permits 14868 and 17781. Permit 14868, issued October 11, 2012, and authorized collection of broodstock from Feather River Hatchery (FRFH) for the Interim Salmon Conservation and Research Facility (Interim Facility) and Salmon Conservation and Research Facility (SCARF). The SCARF is currently under construction. Permit 17781, issued March 21, 2014, authorized collections from FRFH for direct translocation to the SJR, the release of broodstock offspring and ancillary broodstock to the SJR, trap and haul of returning adults, and population monitoring activities. The USFWS is proposing to continue with previously authorized work and to build on reintroduction efforts that began in 2012.

One long-term objective of reintroduction is to develop a genetically diverse broodstock that will lead to the establishment of a naturally-reproducing, self-sustaining spring-run Chinook salmon population in the SJR.

Establishment of a spring-run Chinook salmon population to the upper SJR will restore the species to the southernmost extent of its historical range and provide benefits to the Central Valley Evolutionarily Significant Unit (ESU). A healthy and genetically diverse SJR population would increase diversity, number of individuals, geographic extent, and the overall viability of the ESU. Maintaining captive broodstock would also provide refuge for genetic diversity to ensure the survival of the Central Valley spring-run Chinook salmon ESU in a catastrophic event (e.g., fire, volcanic eruptions, or prolonged drought). The Recovery plan for Central Valley anadromous salmonids recognizes the value of establishing a San Joaquin population and lists the implementation of a spring-run Chinook salmon reintroduction strategy on the SJR as a priority recovery action (NMFS 2014).

At the time of this application, the SJRRP has released approximately 309,068 juvenile spring-run Chinook salmon into the SJR. Broodstock survival at the Interim Facility has been sufficiently high to allow for ancillary broodstock releases and the first broodstock offspring releases in 2016.

Construction of the SCARF, anticipated to be completed in 2018, will increase broodstock holding and rearing capacity and will increase release numbers. Integration of additional donor sources, such as Butte Creek, will increase diversity of broodstock genetics, a primary goal for the SJR population. Using SJR returning adults for broodstock will pass on genetics for a population adapted for the SJR and allow the preservation of a locally adapted genome in critical water years when year class survival is expected to be very low or even zero.

CCV steelhead are not the target species but some may be captured incidentally during monitoring and research activities on the SJR. CCV steelhead will be handled according to the methods outlined the steelhead monitoring permit (16608) or a subsequent renewal of that permit. Steelhead captured during spring-run trap and haul would receive identical treatment to those captured during steelhead monitoring surveys. The two activities will overlap and for January-April will be redundant activities.

Description: General activities to be conducted include broodstock collections, broodstock rearing and spawning, broodstock offspring and ancillary broodstock releases, release of translocated hatchery origin juveniles, trap and haul of juveniles and returning adults, and population monitoring activities.

1.0 Broodstock Collections
In an effort to increase broodstock effective population size, a decision was made to try and double the number of males used in spawning events, so the SJRRP proposes to collect up to 5,400 individuals from all potential sources, although 2,700 is the minimum needed to meet production targets. Because the ratio of juveniles in a population is expected to be 50:50, and because the sex cannot be immediately determined, doubling the number of males in a broodstock population calls for a doubling of the total number of collected

individuals. Additionally, 60 fish from each collection event will be sacrificed for pathology screening at the time of collection and another 10 from each collection event will be sacrificed for pathology screening near the end of the quarantine period. Therefore, a maximum of 5,470 spring-run Chinook salmon eggs or juveniles will be collected for broodstock across all collections, plus including 70 for pathology studies from each collection event. A subset of the collection will be intentional (directed) mortality taken for fish health analysis. The total number of eggs or juveniles collected annually and the collection source will be constrained by the Interim Facility or SCARF capacity and donor stream conditions. If conditions are suitable, the SJRRP would prefer to collect equally from all three donor sources, with collection ratios dependent on acceptable take from each donor source.

If the FRFH is the only available donor source, the SJRRP will collect a maximum of 5,470 individuals from the FRFH including collections for pathology. Actual collection numbers will depend on availability of fish from FRFH and other sources. Under the previous permits 14868 and 17781, FRFH was the only source for broodstock. The SJRRP believes it is important to incorporate genetics from other stocks to begin population establishment with as genetically diverse a population as possible.

The SJRRP proposes to collect a maximum of 2,910 juveniles annually from Butte Creek including collections for pathology (2,700 for broodstock, and 70 for pathology for up to 3 collection periods). Butte Creek collections are further detailed below. SJRRP staff will consult with California Department of Fish and Wildlife (CDFW) Regional staff prior to collections each year to ensure that actual collection numbers are consistent with results of monitoring efforts of the source population.

When spring-run Chinook salmon adults return to the Restoration Area, the SJRRP proposes to collect a maximum of 2,980 juveniles or eggs, including collections for pathology from the SJR. Collections may be done at the adult, egg, and/or juvenile stage. If adults are collected for broodstock spawning, the SJRRP proposes to collect a maximum of ten percent of returning adults, up to 250 individuals annually.

An annual Donor Stock Collection Plan (DSCP) reviewed and approved by the National Marine Fisheries Service (NMFS) and CDFW will outline how many individuals will be collected every year from each donor source, the manner in which collections will occur, and at which lifestage collections will take place. The DSCP will be provided to NMFS at least 60 days prior to any collections. The donor stock collection window is quite long because egg collections at FRFH can take place as early as September, but juvenile collections would take place throughout the spring. The final determination on collecting wild donor stock will be informed by spawner surveys. Since these data will not be available prior to planning egg collections, if the SJRRP modifies actions described in the DSCP, an addendum to the DSCP will be provided to NMFS.

1.1 Feather River Fish Hatchery

The SJRRP proposes to collect up to 5,470 eggs or juveniles from the FRFH for broodstock for the Interim Facility or SCARF. The SJRRP staff will assist with the spawning activities at FRFH to track each cross made, ensuring that egg collections for the SJRRP are from crossed parents exhibiting the spring-run Chinook salmon phenotype. Ovarian fluid samples will be collected from adult females to determine the presence of pathogens. After Fish Health Laboratory clearance, selected broodstock eggs will be transferred from FRFH to the quarantine facility (see Method Section 3.0 Translocation). Up to 70 individuals will be sacrificed for pathology and then pending clearance, the remainder will be transferred to the Interim Facility and SCARF (see Section 1.4 Pathology). Individuals will only be collected that are in excess of what FRFH needs to meet its production targets, so that SJRRP collections will not impact FRFH production obligations. Up to 25 individuals may be sacrificed to set tag depth while coded wire tagging (CWT).

Once preferred crosses of eggs are determined, SJRRP staff will segregate the permitted number of eggs for transport to a quarantine facility for pathology studies. Eggs are preferred for collection because of the ability to target genetically diverse individuals and collect temporal diversity, while maintaining low risk to the donor population.

Furthermore, collection at this lifestage provides greater survival to adulthood in a controlled environment when compared to rearing in the wild, thereby reducing population level

impacts. Eggs also provide the least amount of risk associated with disease transfer due to their ability to withstand disinfection and many pathogens are not vertically transmitted from parent to ova.

Spawning and egg selection will occur in September and/or October during the FRFH spawning season. Egg collection will also occur in September or October. Eggs will be transferred to a quarantine facility, incubated, hatched, reared to a suitable size and transferred to the Interim Facility or SCARF. The eggs and fry will have gone through quarantine and a fish health assessment with approval by the CDFW Fish Health Lab prior to entering the Interim Facility or SCARF.

1.2 Butte Creek

The SJRRP proposes to collect up to 2,910 juveniles annually from Butte Creek (2,700 for broodstock, and 70 for pathology for up to 3 collection periods). The actual number collected will depend on the number of adult returns to Butte Creek the previous spring and the number of individuals collected from other sources as detailed above. Escapement on Butte Creek will be monitored and determined by either direct adult counts at a counting weir or by snorkel survey estimates during the holding period. Escapement estimates by carcass surveys will be used for validation and to account for pre-spawn mortality. These surveys are currently conducted annually. CDFW Regional Staff will be consulted in September or October each year to discuss annual escapement and proposed juvenile collection numbers the following winter and spring. Validation of escapement and confirmation of collection numbers will occur after carcass surveys are complete. Environmental conditions affecting the Butte Creek population (e.g., drought, flood) will also be considered in determining annual collection numbers.

Collection will be dependent on annual escapement and proportion of collections from other donor sources and may range up to 2,910 annually over the permit term, based on the ratio of escapement to viable population size (modified from Lindley et al., 2007). No juveniles will be collected if the number of female spawners is less than 250. The maximum number collected will scale up from 250 on a two to one basis with the number of female spawners up to 1,455. When the number of female spawners exceeds 1,455 up to the maximum of 2,910 juveniles may be collected.

The SJRRP will collect juveniles from existing sampling occurring on Butte Creek to minimize additional handling and incidental mortality, control additional cost, and simplify logistics. Collections on Butte Creek will use the seasonal rotary screw trap (RST) and side diversion trap that are both located at the Parrot-Phelan Diversion Dam near Chico, which are used for annual monitoring of spring-run Chinook salmon juvenile out-migrants (Method Section 1.2 Butte Creek). The site is directly downstream of spring-run Chinook salmon spawning habitat and upstream of fall-run Chinook salmon spawning habitat; although periodically fall-run do spawn above the site. Therefore genetic testing would be performed to avoid mixing fall-run into the spring-run broodstock. All juveniles will then be PIT tagged after being tested and sorted (see Method 2.4.2 and 2.4.4). PIT tagging and genetic testing would occur after fish have reached a minimum fork length of 65 millimeters and may not occur until after juveniles are transferred to SCARF or the Interim Facility. In addition, genetic diversity will be increased by collecting juveniles after juveniles have mixed with other unrelated individuals within the source stream. At these sites, the proposed maximum broodstock collection numbers would represent just 0.1 to 5.3 percent of captured juveniles, based on trap records for the 2012–2013, 2013–2014, and 2014–2015 seasons (Garman 2013, 2014, and 2015).

Collections on Butte Creek would occur throughout the outmigration period in order to capture the genetic diversity for the source population in the SCARF broodstock. Collections may extend through March, which is expected to encompass at least 95 percent of the juvenile outmigration period. During fish processing activities at the RSTs, a subsample of randomly selected juveniles of different size groups would be selected for broodstock collection. Life stages collected (e.g., fry, parr, smolt), fork length ranges for each size group, and numbers collected of each per collection event will vary throughout the collection period in order to represent the diversity seen within the sample catches. Collected juveniles will be transported to the holding site where they will be temporarily held in tanks or cages. Thereafter, juveniles will be transferred to a quarantine facility for a minimum 30-day holding and fish health assessment and, ultimately transferred to, SCARF or Interim Facility. Annual collections from Butte Creek will be segregated into 2–3

groups for quarantine and fish health assessment in order to reduce the potential for disease transfer between early and late collections of fish.

Collected juveniles will be held in self-contained rearing units or cages near (i.e., within 1-hour drive) the collection site during the collection period and prior to transfer for quarantine and fish health assessment. The site will be equipped with electrical power, water, and will be secured to prevent unauthorized entry or vandalism. Staff will be present daily for fish husbandry, system maintenance, and water quality monitoring (e.g., temperature and dissolved oxygen).

Self-contained rearing units would include a 5 hp chiller, mechanical and biological filters, a UV sterilizer, an aeration system, pumps to recirculate treated water, and a circular tank(s) (minimum 500-gallon capacity) capable of rearing up to 7,500 juvenile spring-run Chinook salmon at 200-fish/lb. The SJRRP currently owns several units and will test them prior to deploying for spring-run Chinook salmon collections on Butte Creek. In the event of loss of incoming water, the system would be able to run for up to one week with no adverse effects to the fish. The system will also be equipped with either a back-up generator or solenoid actuated diffused oxygen in case of power failure. If necessary due to equipment failure or unforeseen events, fish may be transferred to holding tanks at Silverado Fisheries Base, the FRFH Annex, Silverado, Satellite Incubation and Rearing Facility (SIRF), or Interim Facility once SCARF construction is completed (see Methods Section 1.2 Butte Creek below) if approved by the Fish Health Lab.

1.3 San Joaquin River Collection

The SJRRP may collect individuals at three different life stages: eggs, juveniles, or adults. Each lifestage has advantages and disadvantages for collection. The SJRRP may collect up to 2,980 individuals from the SJR; however, the number collected in any given year will be determined by the number of adult returns to the Restoration Area and the number of individuals collected from other source stocks.

1.3.1 Egg Collection

Some captive broodstock programs favor redd extraction for broodstock collection due to better control of genetic variation and reduced risk of disease transfer (pers. comm. Barry Berejikian, NOAA). The collection of eyed eggs from redds could be a valuable tool for maintaining the captive broodstock by limiting the potential for any disease transfer into the Interim Facility orSCARF.

Although the SJRRP does not propose pursuing redd extraction on Butte Creek, it is a viable option for collections on the SJR. Redd extraction on Butte Creek would involve additional disturbance to this listed extant stock, and the SJRRP aims to minimize impacts to the donor source populations. The process of extracting eggs from redds on Butte Creek would be costly and logistically challenging due to the location of spawning habitat. Additionally, the necessary monitoring of spawning habitat and monitoring of redds to determine when eggs can be collected would consist of an entirely new eff ort. Within the Restoration Area, all redds are currently identified and monitored, so a large portion of the cost and logistics are ongoing, presenting an opportunity to collect broodstock and refine redd extraction techniques. The extraction itself would represent a small increase in cost to ongoing efforts. Implementing this method on the SJR may open opportunities for pursuing this approach for future collections in other streams.

The SJRRP will pursue two basic methods for redd extractions; either redd pumping or redd excavation. These methods are described in more detail in Section 7.2.1 of the Hatchery and Genetics Management Plan (HGMP) (Börk et al., 2016) and in Method Section 1.3.1. Up to 20 eggs per redd may be collected to be incorporated into broodstock to limit the number of siblings in the broodstock. Broodstock collected as eggs will be transferred or held for quarantine and fish health assessment prior to being transported to the SCARF as described in Section 1.4, Quarantine and Pathology below.

1.3.2 Juvenile Collection

The SJRRP will collect juveniles on the SJR via emergence traps, RSTs, fykes, weirs, or seines. Emergence traps may be placed over up to 40 spring-run Chinook salmon redds to monitor emergence and capture emerging juveniles. Up to 400 juveniles may be collected for incorporation into broodstock. An additional 600 juveniles may be sacrificed for genetic analysis. The rationale for sacrificing 600 juveniles for genetic analysis related to collections from emergence traps was developed in coordination with NMFS personnel (Carlos Garza). Carlos stated the standard 10 samples/redd are needed to determine the number of maternal individuals that contributed eggs to the redd, if the redd is unknowingly superimposed and equal success is assumed. If more than one male contributed to fertilization of the eggs, or differential success of a previously unknown superimposed redd is likely, a greater number of genetic samples would be required per redd. During CDFW review, we decided that 600 samples (approximately 15 samples/redd; 40 redds) would be a sensible compromise in the amount of samples collected while providing a reasonable attempt to determine the number of mothers, the number of fertilizers, provide enough sample duplication if contamination occurs, and to keep intentional take numbers at a restrained total.

Currently (2017), the SJRRP is developing a long-term monitoring program to monitor emigrating juveniles and is conducting an additional study on juvenile trapping as part of an effort to determine the feasibility of a juvenile trap and haul program. RSTs, weir-style traps, fykes, or seines will be used for both monitoring and collection of juveniles from the Restoration Area. Juvenile collections within the Restoration Area will occur throughout the outmigration period in order to capture the genetic diversity for the source population in the SCARF broodstock. Collections may begin as early as November of each year and could extend through May, which is expected to encompass at least 95 percent of the juvenile outmigration period. See Method Section 1.3.2 and HGMP Section 7.2.2 and 7.2.4 (Börk et al., 2016) for additional information.

During the collection period, broodstock collected as juveniles will be transferred or held for quarantine and fish health assessment prior to being transported to the SCARF. Genetic testing will be used to confirm spring-run Chinook salmon origin and manage the genetic diversity in the broodstock and spawning. Each fish will be individually PIT tagged for sorting after genetic testing and for incorporation as broodstock for identification (see Methods 2.4.2 and 2.4.4).

1.3.3 Adult Collection

The SJRRP may choose to collect adults from the Restoration Area to provide stock at the SJRRP spawning and rearing facilities (i.e. SCARF, Interim Facility, or SIRF) or provide passage assistance to the spawning grounds when adults are not able to migrate on their own. Depending on river conditions and facility needs, adults may be collected at two different time periods, either prior to over summering in the system, or in the late summer/early fall just prior to spawning.

All adults will be trapped following the existing protocol for the SJRRP's adult trap and haul program. Adults will be trapped utilizing a fyke net, weir, seine, or dip net as detailed in Section 4.1 Trap and Haul Adults and Section 7.2.4 of the HGMP (Börk et al., 2016). All adults will be identifiably tagged and fin clipped for genetic analysis to confirm spring-run Chinook salmon origin. All individuals will then be transported to the upper Reaches of the Restoration Area where there is suitable spawning habitat, held in in-river net pens, or transferred to a holding facility. Adults collected in the spring and held in a holding facility will be checked for ripeness during the fall. Adults released into the SJR will over summer in SJR holding pools until spawning is estimated to have begun, then will be re-captured and checked for ripeness. If a male and female are found to be ripe and have been determined to be a good match genetically, they will be artificially spawned. Eggs will be incubated and a few will be selected for broodstock. Remaining eggs will be incubated to the juvenile stage, CWT'ed, and released to the SJR to out-migrate.

1.4 Quarantine and Pathology

The transfer of out-of-basin fish to either the SCARF or Interim Facility requires preventative measures to avoid introduction of infectious disease. Some fish pathogens found in California are capable of severely impacting wild fish populations and disease issues can, and have, threatened captive rearing or broodstock programs.

Fish in hatcheries are particularly susceptible to disease due to high fish densities and the added stressors of the hatchery environment. The Interim Facility and proposed SCARF lie in close proximity to the San Joaquin Fish Hatchery (SJH), a major producer of rainbow trout for regional recreational fishing. A Bio-security Protocol is strictly adhered to in order to prevent disease transfer between the facilities (see Section 7 of the HGMP; Börk et al., 2016). The three pathogens of highest concern are infectious hematopoietic necrosis virus, (IHNV) bacterial kidney disease, and Myxobolus cerebralis (Whirling Disease [WD]). Transfer of a virulent pathogen to the trout hatchery or Interim Facility and SCARF such as IHNV, may result in the need to destroy the entire fish inventory for facility disinfection.

Therefore, careful fish health inspections are necessary prior to all fish transfers into a State hatchery facility. For broodstock collections, 60 individuals are sampled for a fish health assessment at the time of collection. After the quarantine period, another 10 are sampled for a pre-transfer health assessment prior to transferring to the rearing facility. These inspections include quarantining fish to investigate all instances of sick, moribund, and dead animals in an attempt to immediately identify the cause of the problem. In addition, a total of 60 fish from multiple brood years may also be euthanized for an annual facility fish health certification. All eggs or fish collections from a given lot may be destroyed when these pathogens are identified during health assessments to prevent introduction of pathogens to the Interim Facility or SCARF and SIRF. After completion of the full-scale SCARF, and pending approval from CDFW Hatchery Coordinator and Fish Health Lab, the Interim Facility may be used for temporary holding, research, and quarantine prior to pathology clearance and transfer to the SCARF.

Fish will be euthanized during disease outbreaks to aid in the identification of pathogens and allow administering proper treatment. Six fish will be euthanized for each occurring epizootic event. In addition, to prevent potential disease outbreaks, diseased and or moribund fish will be removed from the healthy population and, if necessary, euthanized.

Risk assessments for fish transfers will be conducted and based on the USFWS Aquatic Health Policy (713 FW 5). Fish health assessments will be conducted through the CDFW Fish Health Laboratory (Rancho Cordova, California) and based on procedures described in the American Fisheries Society blue book: Suggested procedures for the detection and identification of certain finfish and shellfish pathogens (AFS-FHS 2010). For additional pathology details, including take numbers, refer to the Methods Section 1.4 Pathology.

USFWS will work with CDFW Pathology to determine which quarantine facilities are appropriate for use. If sufficient quarantine cannot be provided by any of the backup facilities or another appropriate site, then proposed fish collections will cease. Quarantine facilities may also be used for short term holding and potentially longer-term holding, if the need arises. Under such circumstances, culture tanks will be made available at the facilities for that specific purpose.

1.4.1 Silverado Fisheries Base

Silverado Fisheries Base (Silverado) in Yountville, California, is the standard quarantine facility for all fish transfers. CDFW operates Silverado for the purpose of juvenile fish and egg quarantine. Previously, all eggs and juveniles going to the Interim Facility or SCARF have been sent to Silverado for quarantine and pathology and the SJRRP anticipates using Silverado for future quarantine. Typically, salmon can be housed at the facility between mid-November through mid-May of each year; however, CDFW has extended this holding period in the past by installing appropriate water refrigeration systems.

1.4.2 Interim Facility and SIRF

After completion of the full-scale SCARF, the current Interim Facility may be used as a quarantine facility pending approval by CDFW Fish Health Lab and/or for research. The Interim Facility will have the capacity to incubate eggs, rear juveniles, and hold adults prior to transfer to the SCARF. Additionally, the SIRF may be used for quarantine purposes. The SIRF is a satellite facility to the SCARF, located at the Bureau of Reclamation (Reclamation) maintenance facility immediately downstream of Friant Dam, 0.75

miles upstream of the Interim Facility and SCARF. The SIRF uses its own water supply line and allows for isolated incubation and the holding and/or quarantine of fish to all but eliminate the risk of disease transfer to SCARF broodstock. More information on these facilities can be found in Section 5 of the HGMP (Börk et al., 2016).

1.4.3 Alternative Quarantine

If other quarantine facilities are not available, then collections will be transferred to Center for Aquatic Biology and Aquaculture (CABA), located in Davis, California, as a backup. CABA's fish culture tanks utilize a secure source of well water which is generally considered free of fish pathogens. CABA has a capacity for hatching a minimum of 40,000 Chinook salmon eggs at one time and is capable of rearing them to approximately 5 grams.

2.0 Broodstock Management

Juveniles and eggs collected from donor stocks will be transported to an approved quarantine facility (Transportation is detailed in Methods Section below) and after clearing fish health assessment, fish will be transferred to the Interim Facility or SCARF. Fish will be reared under controlled hatchery conditions to sufficient age for spawning.
Based on genetic considerations, the goal will be to propagate sufficient numbers of broodstock annually from each donor population to provide between 50-100 from the Interim Facility and 150 – to 450 from SCARF, of unrelated gravid adult females and twice the number of fertile males. Depending on Interim Facility and SCARF capacity, a portion of the broodstock may be released to the SJR as ancillary fish. Ancillary broodstock not utilized for spawning purposes may be released into the river at the juvenile or adult lifestage.

All juvenile fish from the Interim Facility and SCARF will be adipose fin clipped and CWT'ed when they reach the appropriate size. The tags (visually indicated by the removed adipose fin) will allow fish to be identified as belonging to a particular SCARF cohort. All captive broodstock will be tagged using 12 mm passive integrated transponder (PIT) tags after reaching a minimum length of 65 mm. Additional tagging methods may also be used including disc tags, genetic sampling for parental based tagging, or other agency approved marking methods.

After fish reach maturity at the Interim Facility or SCARF, they will be spawned and their progeny reared at the facility from the egg stage to be released to the SJR at the juvenile stage. Some eggs or juveniles may be transferred to the SIRF for rearing and or research. Details for the rearing, spawning, tagging, and releasing of fish are described in Section 9 of HGMP (SJRRP 2016) and Method Section 2.0 Broodstock.

2.1 Rearing and Research Facilities

Salmon rearing and management activities will occur at the SCARF, the Interim Facility, and the SIRF. Each of these facilities has separate water supply lines, so they can be operated independently without risk of disease transfer through the water supply. The Interim Facility is located on the grounds of the CDFW SJH, and has been operational since 2010. The full-scale SCARF will be located next to the Interim Facility along the SJR adjacent to the SJH in Friant, California about 20 miles northeast of Fresno (Fresno County) and one mile downstream of Friant Dam. The full-scale SCARF is anticipated to be operational in 2018, at which time both facilities will be operational together. If the SCARF is not fully operational in 2018, the small scale Interim Facility will continue to be used for the captive broodstock program.

2.1.1 Interim Facility

The Interim Facility has been in operation since 2010 and now includes 3-foot and 6-foot diameter circular tanks, three 16-foot diameter circular tanks, and two 20-foot diameter circular tanks. Each tank is covered to prevent escape and predation. It is designed to rear and spawn about 50–100 pairs of adult salmon pairs annually and up to 200,000 juvenile

salmon. For spawning and incubation, the Interim Facility includes 12-tray vertical flow incubators (Marisource®, Fife, Washington); deep matrix incubators; and a moist air incubator (ARED, Inc., Wrangell, Alaska). In addition, the Interim Facility includes water recirculation and chilling equipment that allows temperature control during incubation and rearing. The systems are capable of operating on flow-through to 95 percent recirculation and include chillers and water filters including solids filters, biological filters, UV sterilizer, aeration and real-time monitoring of water temperature and dissolved oxygen, with an alarm system to notify staff if parameters are out of range. Once the full-scale SCARF is operational, the Interim Facility may be used for quarantine and or for conducting fish research. The Interim Facility may also be used for the holding and spawning of adult spring-run returning to the river, and the incubation and rearing of their offspring.

2.1.2 SCARF

The SCARF will consist of a hatchery building; a smolt production, captive rearing, and holding facility consisting of different sized containers or vessels, piping, and concrete channels for drains and volitional fish releases. The smolt production area would be an open-air area consisting of twelve 20-foot diameter and four 30-foot diameter circular culture tanks used for smolt production. Ventria (operable openings) on the side of the tanks would allow fish to voluntarily enter the release channel system during periods of fish outmigration. Additionally, six 8-foot, six 20-foot, and three 30-foot diameter circular culture tanks will be used for rearing and holding broodstock. The permanent SCARF will be designed to accommodate the maximum broodstock size of approximately 1350 adult broodstock that are spawned at the hatchery per broodyear with a ratio of two males per one female. This maximum number of spawners takes into account additional fish from expected losses of initial broodstock collections due to survivability from one life stage to the next, ancillary releases of broodstock juveniles (0-1), yearlings (1+) and adults used for habitat studies on the river, etc.

2.1.3 SIRF

The SIRF includes four self-contained rearing units, each with five 6-ft diameter 500-gallon circular tanks. The systems are capable of operating on flow-through to 95 percent recirculation and include chillers and water filters. These systems could be used to incubate eggs or rear juveniles prior to release to the SJR. The SIRF could also be used as quarantine for collected broodstock or to temporarily hold adult spring-run Chinook salmon returning to the SJR until they are ready to be spawned. The incubation trailer at the SIRF includes vertical flow egg incubators, deep matrix incubators filled with either natural river substrate or artificial substrate (e.g., Bioballs), and McDonald-style up-welling incubation jars. The trailer is equipped with a water chiller and recirculation system, filters, UV sterilizer, and an aeration system. There is real-time monitoring of water temperature and dissolved oxygen, with an alarm system to notify staff if parameters are out of range. The capacity of the incubation trailer and rearing tanks are approximately 140,000 juveniles per year.

Since 2012, the SIRF has been used for streamside spawning, egg incubation, and juvenile rearing of fall-run Chinook salmon captured in the SJR. Beginning in 2016, the SIRF was used to incubate spring-run Chinook salmon eggs and rear juveniles from the FRFH for translocation into the SJR. It is anticipated that as early as spring of 2018, the SIRF may also be used for the holding and spawning of adult spring-run Chinook salmon returning to the river, and the incubation and rearing of their offspring.

2.2 Releases

The SJRRP determines each year how many fish should be collected from donor populations as broodstock for the SCARF and Interim Facility. This donor stock collection recommendation is based on experience in previous years with broodstock survival from one lifestage to the next, number of age three and four year-old spawners, fecundity, etc. However, these numbers can't always be accurately predicted and the SJRRP, in order to maintain adequate holding capacity for representatives across all brood years, may need to release salmon at various lifestages from age-0 juveniles to adult, although the majority of releases are expected to be as age-0 juveniles at either the parr or smolt lifestage. Other lifestage releases, age-1 to adult, will be conducted to manage facility capacity and for use in studies to inform future decisions and management. Multiple broodyears of

different life stages may be released during the same calendar year; and a particular broodyear may be released at various life stages over a multi-year period. All spring-run Chinook salmon released by the SJRRP will be adipose clipped and CWT'ed.

2.2.1 Juvenile Releases

The vast majority of releases from the rearing facilities will be the progeny of our broodstock, but broodstock will also be released to the river for a variety of reasons. The number of juveniles produced and released from the Interim Facility or SCARF will increase over time as the facility reaches maximum production. However, actual production will vary year to year based on broodstock survival, fecundity and other factors. In some years, we could have more broodstock than we are capable of rearing or need to meet production goals in future years. There may be a need to release juveniles to the river based on these unpredictable factors.

Additionally, to increase the broodstock effective population size, SJRRP increased collections to double the number of males. Because of the 50:50 ratio (males to females), and the unknown sex at time of collection, the doubled collection number produced an excess of the same number of females, that will need to release as ancillary juveniles to the river. These excess females may be released entirely as juveniles. Target releases are expected to be approximately 150,000 juveniles in 2018 and reach maximum production of up to 1,250,000 juveniles by 2021. In an effort to appropriately manage the broodstock population, and in response to river conditions, releases may include up to 1000 ancillary broodstock. All releases will be CWT'ed and adipose fin clipped.

The large-scale releases will occur either as direct volitional release from the SCARF or transported to offsite locations if migratory conditions in the Restoration Area do not support outmigration. Releases will take place between January and April depending on river conditions and fish size.

Fish will be transported from the Interim Facility, SIRF, or SCARF using a transport tank as described in Method Section 3.2 Juveniles. The tank will be filled with raw SJR water immediately prior to transport. Release sites will be near the Interim Facility or SCARF and predicted spawning ground; however, releases may occur much farther downstream to avoid migratory barriers, and transport time may vary. Water will be tempered to near the temperature of the receiving water and will not exceed two degrees Celsius of the river location receiving the fish before releasing fish. When possible, releases will occur at night to minimize predation. For additional information, see Appendix B of the HGMP for the transportation protocol (Börk et al., 2016).

2.2.2 Yearling and Older

The SCARF provides opportunities to study the yearling and adult life stages as part of planned fish releases. Annual releases of yearlings will increase as the SCARF reaches full capacity. In an effort to appropriately manage the broodstock population and in response to river conditions, releases may include up to 2,500 ancillary broodstock annually, primarily as yearlings (age 1+) or at age 2+ or older, as necessary for broodstock population management. Initially, up to 10 percent of the broodstock offspring may be released as yearlings to simulate proportions in natural populations. The actual percentage of yearling releases may change over time based on information gained on the relative survival of release groups, facility operation needs, or new information regarding the proportion of yearling migrants in wild populations.

Adults may be released to the river as part of restoration and ongoing holding and spawning habitat assessments studying fish behavior as well as habitat availability and suitability of river conditions. The number of yearlings and adults released annually from hatchery production will be based on the recommendations of the Fisheries Management Workgroup in consultation with the Conservation and Genetics subgroups of the SJRRP.

Criteria for releasing yearling and older broodstock will be based on:

1. Facility Carrying Capacity – To account for early rearing stage mortality, each year more broodstock will be collected for the Interim Facility-SCARF than may be held when they reach maturity between the ages of two and four. In addition, in an effort to increase the effective population size of the hatchery population, a ratio of 2:1 (male to female) are used during mating, thus resulting in ancillary females. The carrying capacity of the SCARF allows the spawning of approximately 450 adult females with 900 males annually. Each year up to 5,400 individuals may be collected across all stocks for broodstock development. Estimated rearing mortality accounts for losses of approximately 65 percent. In the spring of their second year, the fish inventory will be evaluated and fish releases will be made based on the anticipated loss in the coming years and the carrying capacity of the facility.
2. Genetic Relatedness Data – The genotype of the excess fish above will be examined, and fish will be selected for release in an effort to maximize the effective population size through reducing family size variance in the hatchery broodstock population
3. Sex Ratio Data – Chinook salmon are a semelparous species. Early maturing first and second year males typically die, particularly in a captive rearing program. This disproportionate loss of males results in a skewed sex ratio. An uneven sex ratio can reduce the effective population size. Therefore, in a typical year more females will be selected for ancillary release than males due to the anticipated higher precocity rate and loss of first and second year males, and the desire to increase the effective population size by using a 2:1 (male to female) spawning ratio.
4. Incorporating Captive Reared Adults into Spawning Population – In effort to minimize hatchery induced selection, adults from the broodstock population will be released directly into the SJR to allow natural spawning. Adult broodstock would be transported from the Interim or SCARF facilities using a transport tank, typically from February through September. Adults would be released in Reach 1 and when possible, adjacent to available holding pool habitat. Transfer from transport tank to the river will be achieved when possible by using methods such as water-to-water transfer or released directly from the tank using a pipe or shoot. Direct netting of fish would be minimized to the extent possible to reduce injury and fish stress. Yearling releases would be performed similarly to other juvenile releases and would be conducted with those releases as feasible.

3.0 Direct Translocation

3.1 Collection and Processing

3.1.1 Eggs

Eggs would be obtained from the FRFH in association with the hatchery's standard procedures as outlined in the FRFH draft HGMP (DWR 2009). Eggs are preferred for collection because of the ability to target genetically diverse individuals and collect spatial and temporal diversity, while maintaining low risk to the donor population. Additionally, eggs provide the least amount of risk associated with disease transfer to the Restoration Area due to their ability to withstand disinfection and many pathogens are not vertically transmitted from parent to ova.
The FRFH offers the opportunity for a consistent source of eggs for the SJRRP. FRFH protocols would be followed for the collection, fertilization and incubation of eggs at the FRFH. Procedures will also include pathology testing of ovarian fluid and potentially kidney/spleen tissues. Health inspection data for IHNV and bacterial kidney disease (BKD) are collected from ovarian fluid of returning adult females annually during spawning.

After following the specific mating scheme outlined in the FRFH draft HGMP (DWR 2009), a number of eggs from a minimum of 50 crosses will be segregated for use by SJRRP. Due to space availability, the FRFH may be unable to segregate all crosses into individual egg trays. Therefore, the maximum number of crosses segregated may change each year. A minimum of 50 crosses will be selected by FRFH personnel for segregation throughout the spawning season to maximize genetic diversity.

In accordance with their permit, the FRFH will segregate eggs from individual crosses into egg trays that SJRRP will later target for collections. Once transfer of eggs has been approved by the CDFW Fish Health Lab based on the disease status, and the spring-run timing has been verified, in preparation of transfer, a near equal number of eyed eggs from

each cross will be enumerated by counting, weighing, or by estimating volumetrically up to the maximum allowed. This is the preferred method, since the SJRRP will have the opportunity to select from individual preferred crosses. Eggs from IHNV and BKD negative females will be properly disinfected at (or at the receiving location) FRFH and transported for translocation to the SIRF or additional streamside incubators.

As they develop into juveniles they will be reared at SIRF in 3 to 6-ft diameter circular tanks and may be transferred to in-river holding pens and tagged and clipped when they reach the appropriate size. Eggs for direct translocation can be moved directly to the SIRF without being quarantined and will not be taken to either the SCARF or Interim Facility when operating as broodstock facilities. Eggs for direct translocation may be moved directly to the Interim Facility without being quarantined when broodstock operations shift to the SCARF.

If the FRFH is unable to segregate enough eggs for direct translocation from preferred crosses, then the SJRRP may also select eyed eggs, up to the maximum allowed, from the FRFH spring-run egg trays. However, since the FRFH does not have the space to segregate all crosses it is likely that two to three different crosses may be in one tray. The SJRRP acknowledges that selecting eyed eggs using this method may reduce the number of available preferred crosses since a non-preferred cross (i.e. BKD or IHNV positive female parent) may be mixed with a preferred cross, thus requiring rejection of the entire tray.

3.1.2 Juveniles

An alternative method would be to take juveniles directly from raceways at the FRFH after eggs have hatched. If the SJRRP is unable to accept translocation fish until after egg trays hatch and juveniles are rearing in swim up troughs or raceways, then the SJRRP would select translocation juveniles from the spring-run raceways prior to any marking or tagging that would designate them as Feather River spring-run releases. Any juveniles released into the SJR will be adipose clipped and coded wire tagged. Tagging of direct translocation fish would occur at the SIRF where adequate holding and tagging facilities would be located. Prior to collections, the SJRRP will coordinate with FRFH staff and work closely with them during collections. The SJRRP will follow FRFH standard procedures and practices. Prior to transfer, fish will require a pre-transfer fish health inspection from the CDFW Fish Health Lab which will include the sacrifice of 20 fish per release group for analysis.

Any juveniles requiring transport directly to the SJR or another facility (i.e., SIRF) would be moved by transport tank. Transport will usually occur between January and April. The tank would be filled with water from the source stream, Butte Creek, or FRFH (for transport from FRFH) or from the Silverado Fisheries Base (for transport from the Silverado Fisheries Base) just prior to transport. Transport times would depend on the location, but may be as long as 6 hours. Before transferring fish, the water would be tempered to within 2°C of the water temperature at the receiving facility.

3.2 Incubation and Rearing

3.2.1 Eggs

All eggs destined for translocation to the SJR will be transported when the eggs are the most shock resistant. Trout and salmon eggs become progressively more fragile during a period extending roughly from 48 hours after water-hardening until they are eyed. The eggs must not be moved until this critical period has passed. During the eyed stage, eggs would be addled, cleaned measured, counted, and transported (Piper et al. 1982). Transport should occur between the eyed stage and several days prior to hatching.

Eggs will be placed in a specialized shipping container (e.g., Styrofoam cooler) to reduce excessive movement and limit damage to the egg membrane. Eggs will be segregated in wet cheesecloth, then placed in the shipping container, kept cool and moist using wet ice, and transported in a dark environment. Ice will be in a separate compartment of the

shipping container, so as not to be in direct contact with the eggs. The ideal temperature for transport is between 5 – 10 degrees Celsius (°C). A standard vehicle will be used to transport eggs.
In order to ensure all spring-run Chinook salmon released into the SJR are tagged, eggs will not be directly translocated into the SJR. Eggs will be transported to the SIRF for incubation and rearing to a size suitable for tagging.

3.2.2 Juveniles

Once the juveniles reach an appropriate size they will be CWT'ed and released directly to the river. Pre-health assessment requirements, as defined by CDFW pathologists, will be followed for juveniles. Up to 20 fish per rearing system, but not more than a total of 80 fish, will be euthanized for fish health inspection. Additionally, up to 10 percent of juveniles may be held back and later released as yearlings.

3.3 Releases

Whether transferred directly from the SIRF, FRFH, or reared from eggs, juveniles released into the SJR would either be held in net pens or in transport tanks for acclimation and imprinting before being released to the river. Fish that are raised primarily on San Joaquin water will not require imprinting time. The required acclimation period will be determined as necessary by temperature differential (i.e., a holding time necessary to temper at rate not greater than 1C/hour and not more than 5 C/day). These limitations are based on the following research (Tomasso 1993, DeTolla et al. 1995, Eldridge et al. 2015). Holding times for acclimation may be reduced at the discretion of NMFS to increase predicted survival depending on river conditions (e.g. if fish in holding tanks are exhibiting signs of confinement stress). After the acclimation period, these fish will be released to predetermined locations along the SJR. Fish will be released as high in the system as possible, given water quality and passage conditions lower down in the system, or other logistical considerations.

4.0 Trap and Haul

4.1 Adult

If volitional adult passage is not possible, adult trapping and collections will occur in reaches below the first passage barrier and fish will be transported to above all passage barriers. Fyke traps/nets, or weirs will be deployed in multiple locations in the SJR, connected sloughs, or at fish passage facilities, dip nets, and hand seines will be used to capture adults that stray into smaller irrigation canals. Genetic tissue sampling from live fish will occur at downstream trapping locations prior to transport into the upper reaches. These fish will be externally tagged prior to release to assess spawning success. Acoustic tags and/or PIT tags may also be used for tracking purposes. Further, these tags can be used after genetic evaluation to track spawning adults.

4.2 Juvenile

During years when juvenile fish passage is inhibited (e.g., river is not connected), a trap and haul program may be used to improve survival success of juveniles produced naturally in the system, or as part of streamside spawning efforts. Currently an evaluation of potential trap and haul sites and methodologies is being pursued by the SJRRP. If trap and haul of juveniles occurs, this plan will address adaptive management of any trap and haul program implemented if trap counts are low, or survival in transport is lower than expected.

In general, juvenile Chinook salmon will be captured using outmigrant traps (e.g., weirs, surface collector, RSTs) at locations downstream of redd locations during the winter and spring. Collection boxes will be checked for fish and collection devices cleaned of debris daily. Fish will be netted from collection boxes and transfer to an appropriate sized fish transport tank outfitted with diffused oxygen and/or aerators, and water from fish source. Visual inspections of fish and water quality will be made during transport to release site. Once at the release location, the transport tank water will be tempered to within 2 degrees C of the receiving water by slowly transferring (1C/hr.) river water to the tanks (e.g. increasing the water temperature approximately 1 degree C per hour). Fish release sites will be based on having suitable water quality conditions and proximity to migration obstacles.

5.0 Population Monitoring and Evaluation

5.1 Adult Monitoring

Adult abundance will be used as a measure for evaluating SJRRP success. Calculations from literature based on smolt to adult survival and ocean survival for fall-run Chinook salmon from the Stanislaus River were used to develop take numbers for broodstock collection and as benchmarks to assess reintroduction success. Adults are expected to return 2–4 years following juvenile releases.

5.1.2 Camera Visual Monitoring

Adults are anticipated to return January through August. A camera system (e.g. Vaki) will be used daily to visually monitor when returning spring-run Chinook salmon adults enter the Restoration Area. The camera will be attached to a fyke net or weir as described in the adult trap and haul section. Spring-run Chinook salmon observed by this method will not be captured or handled. However, if river conditions are not suitable for operating a camera system, some capture of adults (e.g. weir, fyke, or other method) may be necessary for adult monitoring.

5.1.3 Snorkel and Acoustic Surveys

Adults in the holding and spawning reaches will be monitored for survival and habitat utilization. Snorkel surveys will be conducted weekly to count and monitor over summering adult spring–run Chinook salmon in available holding pool habitat of the Restoration Area. Surveys will be conducted from February (or when adults first enter holding sub-reaches) through November. Fish will not be handled or captured during holding area observations, and mobile acoustic receivers may be used to track and monitoring fish tagged with acoustic transmitters. This monitoring will include physical habitat monitoring. Additionally, mortalities related to over summer holding will be monitored. As adult holding densities increase over time, density dependent factors affecting survival will be assessed (e.g., disease, stress, illegal harvest). This information will be included in annual reporting for this permit.

5.1.4 Spawning Surveys

Redd surveys and escapement surveys will be used to assess reproductive success of returnees.

Genetic information may be collected from carcasses through the collection of tissues from fresh carcasses. Evaluation of adipose fin presence will be used to determine origin (i.e. hatchery versus Restoration Program, etc.). The head of any fish missing an adipose fin will be collected for CWT extraction and analysis. Escapement may be quantified by marking fresh carcasses using two external tags (e.g., individually numbered aluminum tags attached by hog ring to their maxilla). Escapement is defined as the number of

individuals that escaped the recreational and commercial fisheries (i.e., survived) and were capable of producing offspring (Ross 1997). Although there is no commercial or recreational fishing for salmon permitted in the Restoration Area, evidence of poaching has been observed (e.g., picture on social media, hooks on carcasses; Castle et al. 2016). Unique tag codes may be used for each individual to determine what week an individual was originally detected. Once marked, fresh carcasses will be released in flowing water to ensure "mixture" of the marked population. Recapture of marked carcasses in subsequent weeks will be identified as a recapture and their tag codes recorded. After processing marked and unmarked carcasses designated as decayed or skeletons, their tail will be cut off (between adipose and caudal fin) to prevent the unmarked carcasses from being double counted or marked carcasses removed from the mark-recapture study.

To limit the potential of fall-run Chinook salmon superimposing spring-run Chinook salmon redds, redd grates may be deployed. The initial implementation of redd grates will be to determine their effectiveness at deterring superimposition. If effective, redd grates will continue to be used to protect spring-run redds. Further details are included in the attached protocol for limiting introgression and superimposition of fall-run Chinook salmon on spring-run Chinook salmon.

Emergence traps will be used to assess egg survival in a subsample of redds as it relates to habitat conditions over time. If egg survival is lower than established habitat targets (i.e., lower than 50 percent), it could limit the SJRRP's success in reintroducing the population. This information will be used to recommend habitat restoration projects that may be needed to improve the spawning habitat conditions to support optimal egg survival.

5.2 Juvenile Monitoring

Counts of juvenile relative abundance will be assessed through the use of RSTs or other trapping methods. Juvenile Chinook salmon will be sampled in Reaches 1 and 2 of the Restoration Area, with RSTs placed in locations during near-term monitoring, as well as downstream locations to evaluate survival through the Restoration Area. RSTs will be installed in the following general areas: near the SR 99 Bridge, just downstream of the San Mateo Road crossing, and at a yet-to-be-determined location above the Merced River confluence in Reach 5. Once established, RST site locations will remain fixed each year unless changes in river conditions warrant the need to move them or if new RST sites are considered necessary for long-term study purposes.

CWT monitoring outside the Restoration Area (Mossdale trawls, etc.) will be used to assess migration timing to the Delta. Additionally, acoustic and PIT tagging studies will use spring-run juveniles collected under this permit to begin to evaluate reach specific survival and movement patterns following the same protocols used currently for fall-run juvenile outmigration assessment.

Ongoing or future SJRRP studies that may encounter translocated spring-run juveniles include: Predator Assessment in Reach 1 Mine Pit Habitats; Evaluation of Juvenile Trap and Haul Techniques; Fish Assemblage Monitoring and Inventory; Juvenile Chinook Survival and Migration; and, Egg viability Assessment. Study plans for these studies are available in the Annual Technical Report for the San Joaquin River Restoration Program.

Supplemental Information

Status of Species: Central Valley spring-run Chinook salmon are listed as threatened, and a 10(j) nonessential experimental population of spring-run has been designated in the restoration area. California Central Valley steelhead are listed as threatened throughout their range. Previous monitoring and release of listed fish under Permits 17781 and 14868 are detailed in reports for those permits.

Methods:

1.0 Broodstock Collection

1.1 Feather River Fish Hatchery

Corresponding individual fish data will be collected for each cross; including Hallprint tag number, adipose fin status, head tag number, CWT number, gender, weight, fork length, ovarian fluid sample number, tissue sample number and corresponding genetic analysis data. These data will be used to select preferred crosses.

In accordance with their protocols, the FRFH will segregate eggs from individual crosses into vertical incubator trays that the SJRRP will later remove individual eyed-eggs from for broodstock development. Once disease status and run timing are known, and once eggs have eyed, the SJRRP will randomly select eyed eggs from segregated lots up to the maximum allowed.

If the FRFH is unable to segregate enough eggs for broodstock from preferred crosses (see criteria above), then the SJRRP may also select eyed eggs, up to the maximum allowed, from the FRFH spring-run Chinook salmon egg trays. However, since the FRFH does not have the space to segregate all crosses it is likely that two to three different crosses may be in one tray. The SJRRP acknowledges selecting eyed eggs using this method may reduce the number of available preferred crosses since a non-preferred cross (i.e. BKD or IHNV positive female parent) may be mixed with a preferred cross, thus requiring rejection of the entire tray (See Section 3.1.1 Eggs above).

1.2 Butte Creek

Juvenile collections on Butte creek will utilize existing juvenile monitoring activities so as to minimize potential disturbance to the population. These monitoring activities include the RST and side diversion trap at the Parrot-Phelan diversion near Chico, CA. The site is directly downstream of spring-run spawning habitat and upstream of fall-run Chinook salmon spawning habitat; although periodically fall-run spawn above the site. Collections on Butte Creek will occur throughout the outmigration period in order to capture the genetic diversity for the source population in the SCARF broodstock. Collections will begin in December of each year and extend through March, which is expected to encompass at least 95 percent of the juvenile outmigration period. A small number of various sized juveniles would be randomly selected to prevent collecting siblings. If, after initial collections, it becomes evident that size selection would be useful to eliminate fall-run Chinook salmon individuals from the sample, then that may be used.

Juveniles would be held in tanks or cages near the collection site until the target number of individuals is collected. After collection, broodstock would be transferred and held for quarantine and fish health assessment prior to being transported to the SCARF (See Pathology Section 1.5). One to three groups of fish will be sent to quarantine separately and tested separately.

Rotary Screw Trap Collection
The RST consists of a funnel-shaped cone that is screened and suspended in the water column between floating pontoons. The cone rotates as water flows past the trap, guiding the fish moving downstream into a live box that is attached to the rear of the trap cone. The RSTs are usually installed at a fixed location and they can continuously sample for extended periods. Fish are confined to the live trap, which will be checked at least once daily to process fish and remove debris. Under high debris loads, the trap will be checked and cleaned more frequently. If conditions in the livebox suggest that in-trap predation is a concern, fish refuge devices will be installed within the livebox to dissipate water velocities and reduce predation. If fish refuge devices seem to be causing mortality or injury to listed fish these features would be modified or removed to reduce their adverse effects. When monitored at the appropriate time interval relative to the number of fish being collected, RSTs

result in low mortality rates.

Juvenile spring-run Chinook salmon outmigration is monitored annually by RST on Butte Creek and will be on the SJR. In some cases, capture locations may allow the capture of both fall- and spring-run Chinook salmon. This is less of a concern on Butte Creek, where fall-run Chinook salmon seldom spawn upstream of the sampling location. If, after initial collections, it becomes evident that size selection would be useful to eliminate fall-run Chinook salmon individuals from the sample, then that may be used. In these scenarios, larger yearling spring-run Chinook salmon may be targeted, as they are most readily distinguished from fall-run Chinook salmon. Collected fish will be genetically tested and PIT tagged to verify spring-run Chinook salmon origin sometime after they reach a minimum fork length of 65 millimeters and may not occur until after juveniles are transferred to SCARF or the Interim Facility. . Permitting of RST capture may be achieved by existing permits in the case that those collection activities exist, but the broodstock collection aspect will be covered under this permit.

Pre-Quarantine Holding - Recirculation Rearing System and Cages
Collected juveniles will be held in self-contained rearing units or cages near (i.e., within 1-hour drive) the collection site during the collection period and prior to transfer. The site will be equipped with electrical power, water, and will be secured to prevent unauthorized entry or vandalism. Staff will be present daily for fish husbandry, system maintenance, and water quality monitoring (i.e., temperature and dissolved oxygen.)

Self-contained rearing units will include a chiller, mechanical and biological filters, a UV sterilizer, an aeration system, pumps to recirculate treated water, and a circular tank(s) (minimum 500-gallon capacity) capable of rearing up to 7,500 juvenile spring-run Chinook salmon at 200 fish per pound. In the event of loss of incoming water, the system will be able to run for up to one week with no adverse effects to the fish. The system will also be equipped with either a back-up generator or solenoid actuated diffused oxygen in case of power failure. If necessary due to equipment failure or unforeseen events, fish may be transferred to the quarantine facility if necessary.

1.3 San Joaquin River

1.3.1 Eggs

Eggs will be collected approximately 20-30 days post-spawning from redds, depending on water temperatures. Eggs are most resistant to disturbance after 200 accumulated temperature units (ATU's in degrees C). Eggs will be collected prior to 480 ATU's, which is when hatching can begin for Chinook salmon eggs (Börk et al., 2016). Depending on the specific on-site conditions, either redd pumping or redd excavation may be used as the preferred extraction method, as described below. On-site decisions will be based on water clarity, water velocity, water depth, risk to non-target eggs and safety considerations of field staff. With either technique, eggs will be removed from each redd until the desired number reached (< 20 viable eggs per redd). This equates to approximately < 0.2 percent of the eggs from an individual female. Therefore, a take of 0.4 percent of the eggs from a female at this lifestage should be sustainable as long as survival of the non-taken eggs can be maintained. Egg to fry survival rates in the Interim Facility and SCARF is anticipated to exceed 50 percent, with a target of 70 percent or greater. Egg to fry survival in naturally spawned Chinook salmon eggs is extremely variable, and depends on a number of factors, including temperature, flow, gravel composition, percolation rate, etc. Total eggs collected will depend on redd availability.

1. Redd Pumping (as described in Börk et al., 2016)
If redd pumping is conducted, eggs will be collected from redds using a small portable backpack mounted water pump as described by Murdoch and Hopely (2005). An aluminum probe is inserted into the redd. The probe is designed with an air intake, which creates a Venturi effect that combines water and air. The mixture of air and

water is used to float eggs to the surface. A collection basket covered with wire mesh and a cloth net bag on the downstream side will be used to collect eggs. The basket will be placed over the portion of redd to be sampled. In an effort to minimize stress to the redd, hydraulic sampling will begin at the farthest most downstream point of the tail spill and progressed systematically upstream as necessary. This method ensures that disturbance to the redd is confined to the furthest downstream portion of the redd, decreasing the probability of impacts from personnel (i.e., stepping on egg pockets) or the sampling process (e.g. changing the hydraulics of the redd). Each redd will be sampled carefully until the first egg is collected and the developmental stage verified (i.e. eyed-egg stage). Eyed-eggs will be removed from the collection net by hand or with a small dip net and placed in small buckets. Buckets will then be placed in coolers on ice for transport to quarantine. Excess eggs will be re-injected into the redd using the hydraulic egg planter or carefully returned to the redd by hand.

2. Redd Excavations (as described in Börk et al., 2016)
Redd excavation consists of carefully hand-digging into the tailspill of identified spring-run redds to obtain live fertilized eggs. The specific redds from which eggs are to be obtained, will be selected from areas of shallower water and gentle velocities to facilitate obtaining eggs without loss. Gravel will be carefully removed from the tailspill of the red, by hand until eggs are reached. The digging process will proceed slowly so that a clear view of the excavated area can be maintained throughout the process. Snorkel gear will be used to get a clear underwater view of the excavated area. A fine mesh dip net will be used to retrieve the eggs. Eggs will be placed into a bucket of river water, maintained at or below the temperature of the river, as they are removed from the gravel. They will be counted as they are placed into the bucket until the desired number of eggs is reached (< 20 eggs). Once the eggs are obtained from the redd, gravel will be carefully replaced into the area from which it was removed until the pre-disturbance substrate contour is recreated.

1.3.2 Juveniles

Juvenile collections within the Restoration Area would occur throughout the outmigration period in order to capture the genetic diversity for the source population in the SCARF broodstock. Methods may include RST, weir-style trap, fyke, or seine. Collections would begin as early as November of each year and could extend through May, which is expected to encompass at least 95 percent of the juvenile outmigration period. A small number of various sized juveniles would be collected each week so as to limit the likely number of siblings in the sample, and genetic testing would be used to confirm spring-run genetics. Juveniles would be held in tanks at the SIRF until the target number of individuals is collected, when the group would be held for 30-day quarantine and pathology clearance prior to being transferred to the SCARF. RST methods are described in Section 1.2 for Butte Creek above.

1. Fyke Net or weir-style trap (as described in Börk et al., 2016)
Fish weirs are porous barriers built across streams to capture migrating fish in flowing waters and generally have much higher capture efficiency than RSTs. There are many different types of juvenile collection weirs and they can be constructed from a range of materials based on site conditions, but generally they function very similarly. Fykes or v-shaped weirs direct downstream migrating fish into a collection box. Similar to RSTs, these traps have very low mortality rates when checked and cleared of debris at least once daily. All juvenile traps (RST, fyke, and weir) will be emptied at least once daily, and more frequently when fish or debris loads require. Daily trap checks will include visual inspection, and traps will be cleaned and maintained as necessary.

2. Seine
A seine consisting of a length of fine mesh netting with a weighted lead line bottom and floating buoy top line will be set from shore. The seine will be pulled through the water to encircle fish and then closed off against the adjacent shore, entrapping fish. Juvenile Chinook salmon entrapped in the seine purse will be subsequently processed and removed for transport. Seines of various lengths and mesh sizes may be used depending on location and conditions, and the number of personnel required to use the seine in manner that is safe for personnel and fish will vary accordingly. Personnel seining will be careful not to seine debris in a manner that could injure

listed fish, and will inspect the seine in the water to be sure that all seined fish are accounted for and processed appropriately.

3. Emergence traps

Fry emergence monitoring will be conducted in conjunction with the carcass and red monitoring using emergence traps (Koski 1966; Hausle and Coble 1976; Beacham and Murray 1985; TID and MID 1991). A stratified random sampling design based on time periods and survey reaches will be used to select redds for emergence monitoring. Water temperature data for each redd will be obtained from the nearest CDEC gaging station to estimate emergence timing via accumulated thermal units prior to installing emergence traps (ATUs; Beachum and Murray 1990). ATUs will be calculated by adding average daily temperatures, 1 ATU = 1 °C for 1 day (Beacham and Murray 1990) and assume that emergence will start at approximately 700 ATUs. Emergence traps will be installed on selected redds no more than two weeks (i.e., 3 to 14 days) prior to the start of expected emergence to minimize the potential for the traps to influence the hydrogeomorphology within monitored redds.

Emergence traps consist of 0.32-cm nylon mesh covering a steel frame and a 30.48-cm canvas skirt made of Dacron sailcloth buried vertically into the gravel to minimize lateral escapement of fish. Emergence traps are tear-shaped and contain a live-box at the narrower caudal end of each trap, which is oriented downstream. Emergence traps measure 2.42-m long and 1.83-m at the widest point, and had an area of approximately 2.83 m2. The live-box is assembled to collect emerging fry using a 3.79-L wide-mouth polyethylene bottle attached at the bottom to a 15-cm diameter funnel. Holes are cut into both sides of the live-box and 0.32-cm polypropylene mesh is attached with silicone to create a vent, allowing water to escape and minimizing fish mortality. A sock constructed of Dacron sailcloth extended from the downstream end of the trap to the live-box is attached using a hemmed drawstring around the lip of the funnel.

During installation, each emergence trap is placed on top of the distinct egg pocket. Subsequently, rebar measuring 0.95-cm thick by 76.20-cm long is installed around the emergence trap frame and secured to the frame using washers and hose clamps. The rebar is installed approximately 50-cm into the riverbed using a manual post pounder. Thereafter, a trench will be excavated around the edges of the trap at a depth of 30.48-cm or until the substrate becomes too armored for digging to continue. Finally, a canvas skirt is buried within the trench, the excavated area is backfilled, and the live-box is attached to the narrow caudal end of the emergence trap to begin sampling. Emergence traps will be checked and cleaned 2–3 times each week. Emerged alevin or fry captured within the live-box are counted and measured to the nearest mm FL. Other fish species (e.g., cottids, petromyzontids) captured in the live-box are identified to species, measured to the nearest mm FL, and enumerated. After processing, all fish are released into the river. When fish are no longer being collected within the emergence trap for one week, the emergence cap is removed and the redd is assessed for nonviable eggs, entombed alevins, and emerged juveniles that did not enter the live-box. This process helps to better assess survival rates or identify the presence of a "false redd" (i.e., no eggs were ever deposited at the location).

1.3.3 Adults

Adults will be collected by fyke, weir-style trap, dip net, or seine in the SJR. Collected adults will be tagged (i.e. T-bar, disc, PIT, and/or acoustic), fin clipped for genetic analysis, and released into the upper SJR to hold until spawning in the fall. Alternatively, adults may be held in net pens or at SIRF, Interim Facility, or SCARF until spawning in the fall. After genetic analysis has determined suitability for broodstock and desired mating based on relatedness, fish pairs will be collected and artificially spawned at the Interim Facility or SIRF. Spawning will be performed using the methods described in Section 2.2. During spawning, ovarian fluid will be sampled to test for BKD and IHNV. Eggs will be incubated and juveniles will be held for quarantine. For pathology, 60 juveniles from each holding group will be sacrificed. Following pathology, a small number (< 20) of the eggs or juveniles per female will be incorporated into the broodstock at the SCARF. Additional juveniles will be reared until they reached a size suitable for tagging, CWT'ed, and released in the SJR to out-migrate.

Under certain conditions, the SJRRP may decide to collect adults prior to the adults being mature. Under this scenario, the adults will be collected and held in tanks at

the current Interim Facility or SIRF, or in net pens in the SJR below Friant Dam, until mature. Those adults will be selectively mated and artificially spawned following the same procedures as described above.

1.4 Pathology (all hatcheries)

The general process for fish health assessment involves first analyzing the ovarian fluid and possibly kidney and spleen tissue for adult spawners at FRFH. Next, eyed eggs or juveniles are transferred to a quarantine facility, whose water supply is free from virulent fish pathogens. For eyed eggs, this will typically occur sometime in mid-October and for juveniles will occur sometime between November and April of each year.

After all fish or eggs from the group or lot have entered quarantine, have hatched and reached a minimum size of 40 millimeters (mm) and they are approximately one month prior to the target transfer date, 60 fish per lot (up to 4) will be sacrificed for pathogen testing. Analysis for each sample takes approximately 30 days for processing. Just prior to transport to another facility, up to 10 fish per lot will be sacrificed for a pretransfer fish health survey and again analyzed for pathogens in effort to capture any outbreaks that may have occurred during the 30 day sample analysis. FRFH broodstock collection will be subject to a sampling event for a virology test where 60 fish are euthanized, and one pre-transfer fish health survey where a maximum of 10 fish are euthanized. All fish or eggs collected from FRFH will be sampled as one group.

Butte Creek sampling will occur over several months with a maximum of three lots collected. Each lot may be transferred to the quarantine facility as a single group or in smaller subgroups, based on the timing of collection (e.g., early and late outmigrants). Each lot will be held in a separate tank with separate water supplies to avoid disease transfer between lots. Each lot will be subject to a sampling event for a virology test where 60 fish are euthanized, and one pretransfer fish health survey where a maximum of ten fish are euthanized.

SJR sampling will occur over several months with a maximum of four lots collected. Each lot may be transferred to the quarantine facility as a single group or in smaller subgroups, based on the timing of collection (e.g., early and late outmigrants). Each lot will be held in a separate tank with separate water supplies to avoid disease transfer between lots. Each lot will be subject to a sampling event for a virology test where 60 fish are euthanized, and one pretransfer fish health survey where a maximum of ten fish are euthanized.

If fish from the same lot enter quarantine over a period of time, pathogen testing will begin after the last fish from the lot enters quarantine, and still only 60 fish will be needed to be sacrificed. After fish health clearance has been received, the "cleared fish" will then be able to be transferred to the SCARF.

In addition, the CDFW Fish Health Lab typically conducts an annual Fish Health Certification for each hatchery which requires the sacrifice of 60 fish of varying sizes for health assessment. The sacrifice of 60 fish is not mandatory for ESA listed species, but is prudent to assess the health of the hatchery population.

Pathology Screening Summary:
1. Fish Health Assessment – Involves take of 60 individuals for analysis of viruses, bacteria, and parasites. It takes at least 30 days to receive testing results. This is what occurs during quarantine. Done when fish are moved from the wild into a CDFW facility or from hatchery to hatchery.

2. Pre-release Health Assessment – Conducted prior to releasing fish to wild. Typically involves euthanizing 20 fish per release group.

3. Pre-transfer Health Assessment – Conducted prior to transferring fish to another hatchery, just prior to the transfer. Typically involves euthanizing 10 fish per transfer group.

4. Diagnostic Health Assessment – Conducted on moribund fish experiencing an epizootic event. Typically involves euthanizing 6 fish per group infected per event.

5. Facility Health Certification – Conducted annually using multiple year classes, requiring the sacrifice of up to 60 individuals to assess the disease status of a facility.

2.0 Broodstock Management

2.1 SCARF

Rearing facilities will be organized into three main areas: fry production, smolt production, and captive rearing. Fry production will occur in the main hatchery building where fish will be reared from the unfed fry stage to about 3 grams each in 28 rectangular rearing troughs. Smolt production of fish from 3 grams to 7.5 grams, and yearling production from 7.5 grams to 75 grams, will occur outdoors in the exterior hatchery area. The smolt production area will be an open-air area consisting of twelve 20-foot diameter and four 30-foot diameter circular culture tanks used for smolt production. Ventria (operable openings) on the side of the tanks would allow fish to voluntarily enter the release channel system during periods of fish outmigration.

Broodstock and captive rearing of fish for adult production from yearlings (75 grams) to adults (> 1 kilogram) also will occur outdoors in the exterior hatchery area using six 8-foot, six 20-foot, and three 30-foot diameter circular culture tanks. All outdoor tanks will be equipped with automatic feeders, include netted or solid-roof bird enclosures, and feature a flow-through water system.

The fry production facility will use rectangular tanks for early feeding and for juvenile segregations, and will be monitored for early mortality. After reaching about 3 grams, family groups will be combined in larger circular holding tanks. Eight-foot circular tanks will be used for rearing fish up to age 2, and 20- and 30-foot tanks will be used for rearing fish from age 2 until maturity. During captivity, tank flushing rates will be less than one turnover per hour and the maximum allowable fish density index will be 0.15 lb /ft3/in, as proposed by Banks (1994) and Ewing and Ewing (1995) for spring-run Chinook salmon.

The SCARF will utilize high quality slow sinking salmon feed from a reputable fish feed manufacturer and frozen krill will be fed to fish starting at an estimated 2-years of age to increase feed consumption. Feed rations will vary in order to modulate fish growth rates according to the facility requirements and to help reduce precocity. Feeding charts will be used to guide the number of feedings and feed amount per day (by percent body weight).

2.2 Spawning

Consistent with the standards and guidelines outlined in the 2016 HGMP, all male broodstock at the Interim Facility, SIRF and SCARF, and female broodstock will be examined weekly during the spawning season to determine ripeness, and all fish will be spawned when ripe. To allow the hatchery to identify close relatives and minimize mean kinship, all potential spawners will be genetically analyzed and a relatedness estimate (e.g., Queller and Goodnight 1989) will be developed for all pairings of broodstock fish (Kozfkay et al. 2008, Sturm et al. 2009), both potential breeding pairs (to evaluate potential mates) and same-sex pairings (to detect full-siblings). Based on the molecular relatedness estimate, a spawning matrix will be constructed following Sturm et al. (2009). Briefly, the matrix will be organized by female, with all potential male mates listed below her in order of preference, based on their coefficient of relatedness (most desirable male is the least

genetically-related). Additional details on spawning practices are described in Section 8 of HGMP (SJRRP 2016).

Actual pairings will involve the four males with a low relatedness value when the female is ripe, and no matings will involve fish related at the level of half-sibling or greater. Females to be spawned will be euthanized by a sharp blow to the base of the skull using a blunt object. The ventral wall of the abdominal cavity will be slit open and eggs allowed to freely flow into a metal spawning pan (Leitritz and Lewis 1976). Milt from males will then be expressed into the pan by stroking the vent area.

Eggs from each female will be divided into four groups of roughly equal size and each will be fertilized by a different male. Each male will be used with no more than four different females. Eggs and fry from each cross should be kept separately until the major period of in-hatchery mortality is passed to allow for evaluation of the success of the cross.

The flaccid eggs will be put into incubation trays. Eggs and fry from each cross will be kept separately until the swim-up stage to allow for evaluation of the success of the cross. As available, and as governed by the recommendations of the hatchery and river monitoring technical teams, precocious males and jacks will be used to ensure representation of alternative life history strategies.

2.3 Incubation

Incubation and rearing operations will occur at the SCARF or Interim Facility. Eggs will be incubated and then reared under controlled hatchery conditions to sufficient age and size to be tagged and released to the river. Each vertical flow incubator (consisting of 12 trays) will be operated at the manufacturer's recommended flow rate of 3-6 gallons per minute, depending on the loading density. Loading densities will not exceed 8,000 eggs per tray, although egg tray capacity is 10,000 eggs. Individual family lots will be segregated into four sections per egg tray using segregation dividers. Opaque side panels will be added to the incubators to produce a darkened environment for incubation. All egg incubation will occur in darkened conditions. Deep matrix incubators are hatch boxes that provide a substrate (i.e., plastic rings) for hatching to mimic in-river conditions by requiring "emergence." The units will be single pass through flow systems, and will be operated at the manufacturer's recommended flow rate. Each unit has a recommended loading rate of 200,000 salmon eggs.

Moist air incubation produces a fine mist for incubation to inhibit fungal growth. The moist air incubator will have 220 individual egg trays to allow isolation and tracking of individual parental crosses. Each egg tray will hold 2,700 eggs, with a total capacity of almost 600,000 eggs per unit. The unit will recirculate 40 gallons of filtered water, with 5 gallons of water replaced daily. Filtration will consist of 1 and 50 micron particle filters, a 10 micron carbon filter and ultraviolet sterilization. The moist air unit will incubate green eggs through the eyed stage in a dark environment, after which the eggs will be transferred to deep matrix or vertical tray incubators for hatching.

The deep matrix incubators and the vertical tray incubators will utilize ambient water temperatures, anticipated to be between 45 – 55ºF (7.2 – 12.8ºC). As the moist air incubator will allow for temperature control, hatching temperatures will be based on the objectives of the SJRRP and may include: mimicking SJR temperatures, slowing or speeding egg development, and/or utilizing temperature to produce thermal marks on otoliths. Dissolved oxygen levels will be maintained near saturation. Eggs will be monitored daily, and visibly dead eggs will be removed. Siltation is not anticipated to be a problem because the water supply comes from Lake Millerton and the reservoir will allow sediments to settle out before reaching the hatchery intake.

2.4 Tagging

2.4.1 Handling and Anesthesia

All measuring and marking activities will require netting, removal and handling. To minimize the likelihood of such affects, Tricaine Methane Sulfonate (MS-222) or carbon dioxide (e.g. Alka-Seltzer or compresses cylinders compressed gas) anesthesia will be administered to juveniles during measuring and weighing activities and PIT tag implantation. Dosage and administration will follow protocols outlined in the draft FRFH HGMP (DWR 2009). All processed fish will be allowed to recover before returning to the rearing tanks. Although physical damage from tag implementation is possible, the stress associated with the injury is likely to subside after 12 hours (Gadomski et al. 1994).

2.4.2 Fin Clip and Genetic Sampling

The entire population of captive reared broodstock will be genotyped for parental based tagging. A small fin clip will be collected from spawned fish and either dried on blotter paper or stored in ethanol. The tissue samples will be sent to the CDFW Tissue Archive in Sacramento where half of the tissue will be archived and half will be sent to a contracting lab for genetic analysis. In the lab, the genetic sample from each fish will be genotyped and identified for sex. The results will be stored in a parent database. When suspected offspring are sampled subsequently, they too will be genotyped, their parents located in the database and the stock and cohort of origin recorded.

2.4.3 Code Wire Tagging

CWTs are small (less than 1 mm) lengths of wire implanted into the snout of each juvenile fish using specialized automated equipment. Before spring-run juveniles are released to the river, each individual is CWT'ed. Tagging occurs when the fish are at a minimum of 30 mm in length. Tagging facilities will consist of one or more mobile manual-tagging trailer(s), or an individual tagging station will be used. Inside the tagging trailer, fish are size graded and distributed to tagging stations with corresponding appropriately sized head molds for CWT insertion. Tagging stations consist of a CWT machine, and quality-control device that ensures the tag is inserted. Calibrating CWT machines for appropriate tag length and insertion depth requires lethal take. The number of fish required for lethal take depends on multiple factors such as: size distribution of fish, the number of fish tagged, the number of days fish are tagged, and the type of equipment used for tagging. The maximum numbers of take for the CWT process is listed in the take tables below. If the number of fish to be tagged places too high a demand on the three station manual-tagging trailer, another manual-tagging trailer may be brought in from the Merced Hatchery. The SJRRP may also at some point incorporate an automated tagging trailer into its tagging operations.

2.4.4 PIT Tag

Broodstock reared at the SCARF also will be tagged using 12 mm PIT tags after reach length of 65 mm. Sterilized PIT tags will be implanted into the peritoneum. PIT tags will be used for monitoring individual fish throughout captivity. Reared juveniles would be measured and weighed, implanted with a PIT tag, and tissue would be collected for genetic analysis (as mentioned in Method 2.4.2 above). To minimize the potential for detrimental effects, MS-222 anesthesia would be administered to juveniles during measuring and weighing activities and PIT tag implantation. Dosage will range between 25 to 100 PPM, based on weight of the fish, ensuring the minimum amount of substance necessary to immobilize each individual for handling and sampling procedures.

2.4.5 External

Captured fish may be tagged externally, below the dorsal fin, with a uniquely numbered disc or anchor tag (e.g., t-bar, dart), to easily identify fish after release. Different color tags may be used to distinguish between gender, and release date. T-bar or disc nickel plated adult fish will be anesthetized during all tagging activities using MS-222 or carbon dioxide. The dosage of the anesthetics will be adjusted to avoid fish mortality.

2.4.6 Acoustic

Juvenile spring-run Chinook salmon may be tagged with Juvenile Salmon Acoustic Telemetry System (JSATS) or other appropriate acoustic technology (e.g. tag transmitters appropriately sized for the individual fish). Tagging will be conducted in the Interim Facility, SCARF, SIRF or the mobile processing trailer. Acoustic tag placement will involve surgical techniques requiring an approximate ½ inch incision closed by suturing with standard absorbable suture material by staff experienced in the procedure. Fish will likely be recovered for no less than 24 hours but possibly sooner (depending on environmental conditions and discretion of biologists) to ensure no latent mortality from surgical implanting of tags.

Acoustic and Archival Tagging of Adults will either be: 1) surgically implanted through a one-inch abdominal incision and sutured closed, 2) gastrically inserted using a balling gun, or 3) attached to the fish externally by affixing the tag below the dorsal fin rays using stainless steel wire or fishing line inserted through the dorsal musculature would then be attached to the tag harness and excess mounting wire removed for a snug fit. Acoustic tags may be coupled with archival temperature tags by affixing each other with glue or by heat shrink tubing to improve recovery of archival tags. Tagged fish may be anesthetized to surgically implant tags.

2.5 Juvenile Rearing and Releases

Juveniles will be released to the system by different methods and lifestages depending on river conditions and broodstock management. Prior to juvenile passage being present in the system, juveniles will be trucked downstream to locations where they can migrate out of the system. Once river conditions improve, juveniles will be released as high in the system as prudent, given connectivity and logistical limitations.

Juvenile salmon out-migrate in groups, which may reduce mortality due to predation. Temporarily holding juveniles and releasing them in a series of groups may more closely resemble natural densities experienced during rearing and outmigration and increase their survivorship. Release sites will be selected to provide appropriate water depth, velocity, substrate, and cover characteristics to promote juvenile growth and survival. If SJRRP biologists determine that conditions are not suitable for fish holding, and that the fish are adequately imprinted to San Joaquin water, then holding times may be reduced to increase survival.

In the first few years before complete connectivity between Friant Dam and the confluence with the Merced River, most fish will be released in Reach 5. In the case of a flood year, when there is complete connectivity, fish may be released higher up in the SJR.

2.6 Holding and Net Pens

Holding pens (cages) will be constructed of 1 inch aluminum angle frame that are 3' x 3' x 4' and have 1/8 mesh aluminum panels bolted inside the frame. The cages will be suspended between two repurposed rotary screw trap pontoons that are 2' wide x 22' long x 1.5' deep. The cages will be configured is such a way that approximately 1 foot of the cage is above water, leaving a 3' x 3' x 3' portion of the cage in water to allow sufficient space for automatic feeders. Net pens will consist of a 10' X 10' X 6' net (1/8 mesh), framed with 3" X 2" aluminum tubing attached to pontoons. Cages and net pens will be weighed down by concrete blocks tied to the corners of the pens and sunk to the bottom of the river. Holding/Net Pen specifics may be modified in the future to accommodate SJRRP requirements.

2.7 Volitional Passage

Once the SCARF Facility is completed, juveniles may also be released volitionally through a volitional release channel into the side channel of the SJR. Fry may be released into the river immediately after CWT tagging and removal of adipose fin. Release would occur volitionally onsite, or fry would be transported to specific locations for release. Release sites will be selected so as to provide appropriate water depth, velocity, and substrate, and cover characteristics to promote fry growth and survival.

3.0 Direct Translocation

Depending on the lifestages targeted for each reintroduction, several direct or indirect release methods are proposed. These methods were chosen to allow the best chance of survival for each lifestage and will be monitored to address additional unforeseen factors and improvements that may be needed. All fish (eggs and juveniles) will be quarantined based on CDFW's Fish Health Assessment recommendations (see Section 5.3 Quarantine and Pathology). After fulfilling pathology/quarantine requirements, fish collected for direct translocation to the SJR may be held at the SIRF or in net pens in the river (to facilitate imprinting, tagging/marking, etc.) before release. Eggs for direct translocation will not be sent to a quarantine facility. Health inspection data for IHNV and BKD are collected from ovarian fluid of returning adult females annually during spawning. Eggs from IHNV and BKD negative females will be properly disinfected at or SIRF or FRFH, and transported for incubation and rearing at SIRF prior to being released as juveniles to the SJR. Eggs for direct translocation may be transported to SIRF or to river net pens, but will not be taken to the Interim or SCARF facilities.

3.1 Egg Collection and Release

Individuals will be randomly selected from preferred crosses/trays from FRFH for direct translocation. Corresponding individual fish data will be collected for each cross; including Hallprint tag number, adipose fin status, head tag number, CWT number, gender, weight, fork length, ovarian fluid sample number, tissue sample number and corresponding genetic analysis data. These data will be used to select preferred crosses for the SJRRP. All spring-run Chinook salmon released into the SJR will be tagged therefore eggs will not be directly translocated into the SJ R. Eggs will instead be transported to SIRF or similar streamside incubation facility.

Once they hatch, fry would be moved to deep matrix incubators, or 3-ft diameter circular tanks, and eventually 6-ft diameter tanks. As they develop into juveniles they will be CWT'ed once they reach the appropriate size. These juveniles will then be trucked to release locations in the SJR; either into net pens for acclimation, or directly to the river after acclimating in transport tanks.

3.2 Tagging Facilities

Tagging facilities will consist of a mobile trailer having a sufficient work area to accommodate up to three to five CWT machines. The trailers will most likely be housed at the U.S. Bureau of Reclamation facility at Friant Dam or at the SCARF. Water for each trailer will be from the adjacent raw river water supply with discharge returned to the river.

3.3 Juvenile Rearing and Releases

Juveniles may be released into the SJR at various ages and sizes. Juveniles may be released over the same temporal window as collection or availability occurs. All measuring and marking activities would require netting, removal and handling. Although physical damage from tag implementation is possible, the stress associated with the injury is likely to subside after 12 hours (Gadomski et al. 1994).

4.0 Trap and Haul

4.1 Adult

If volitional adult migration is prohibited, adult trapping and collections will occur below passage barriers and fish will be transported upstream to accessible holding and spawning habitat in the Restoration Area. Fyke nets or weirs will be deployed in multiple locations in the SJR, connected sloughs, or at fish passage facilities, and dip nets will be used to capture adults that stray into smaller irrigation canals. Fyke nets or weirs will be constructed of two wing walls funneled to a live box trap and anchored to existing vegetation or t-posts in stream. Wing walls may extend to one or both stream banks depending on location and the presence of boater traffic. If boater traffic is present, fyke net placement will allow for boat traffic to pass uninhibited on the deeper side of the channel, with a maximum of 75 percent of the channel width and outfitted with flashing lights for visibility. Fyke nets are operational up to a maximum of 1,000 cfs flow, and may be removed within 24 hours if required. Marking and tagging such as genetic tissue sampling and acoustic tagging may occur at downstream trapping locations prior to transport into the upper reaches where they have access to holding and spawning habitat. These fish will be externally tagged prior to release to assess spawning success. Acoustic tags and/or PIT tags may also be used for tracking purposes. Further, these tags can be used after genetic evaluation to track spawning adults. A subset of the captured adults may either be transported to the SIRF or Interim Facility to be held for use as broodstock, or released upstream to hold to be later recaptured for use as broodstock. The methods used for downstream captures would be similar to those adults recaptured upstream.

4.2 Juvenile

During years when the river is not connected, a trap and haul program may be used to improve survival of juveniles produced naturally in the system, or as part of streamside spawning efforts. An evaluation of potential trap and haul sites and methodologies is being pursued by the SJRRP. If trap and haul of juveniles occurs, the plan will address adaptive management of any trap and haul program implemented if trap counts are low, or survival on transport is lower than expected.

In general, juvenile Chinook salmon will be captured using outmigrant traps (e.g., weirs, surface collector) at locations downstream of redd locations during the winter and spring. Collection boxes will be checked for fish and collection devices cleaned of debris daily. Fish will be netted from collection boxes and transferred to an appropriate sized fish transport tank outfitted with diffused oxygen and aerators. Visual inspections of fish and water quality measurements will be made during transport to release site. Once at the release location, the transport tank water will be tempered as necessary (at a rate not greater than 1C/hour and not more than 5 C/day in the transport tank) by slowly transferring river water to the tanks. These limitations are based on the following research (Tomasso 1993, DeTolla et al. 1995, Eldridge et al. 2015). Fish may be released more quickly if they are exhibiting confinement stress. Fish release sites will be based on having suitable water quality conditions.

5.0 Population Monitoring and Evaluation

5.1 Adult Monitoring

Adult abundance will be used as a measure for evaluating SJRRP success. Calculations from literature based on smolt to adult survival and ocean survival for fall-run Chinook salmon from the Stanislaus River were used to develop take numbers for broodstock collection and as benchmarks to assess reintroduction success. Adults are expected to return 2-4 years following juvenile releases.

5.1.1 Camera Visual Monitoring

Adults are anticipated to return January through August. A camera system (e.g. Vaki) will be used daily to visually monitor when returning spring-run Chinook adults enter the Restoration Area. The camera will be attached to a fyke net or weir as described in the adult trap and haul section. Spring-run Chinook salmon observed by this method will not be captured or handled. However, if river conditions are not suitable for operating a camera system, some capture of adults (by weir, fyke or other method) may be necessary for adult monitoring.

5.1.2 Snorkel and Acoustic Surveys

Adults in the holding and spawning reaches will be monitored for survival and habitat utilization. Snorkel surveys will be conducted weekly to count and monitor over-summering adult spring–run Chinook salmon in available holding pool habitat in the Restoration Area. Surveys will be conducted from January (or when adults first enter holding sub-reaches) through November. Fish will not be handled or captured during observations, and mobile acoustic receivers may be used to track and monitoring fish tagged with acoustic transmitters. This monitoring will include physical habitat monitoring. Additionally, mortalities related to over-summer holding will be monitored. As adult holding densities increase over time, density dependent factors affecting survival will be assessed (e.g., disease, stress, illegal harvest). This information will be included in annual reporting for this permit.

5.2 Spawning Surveys

Redd surveys and escapement surveys will be used to assess reproductive success of returnees. Genetic information may be collected from carcasses through the collection of tissues from fresh carcasses. Evaluation of adipose fin presence will be used to determine origin (i.e. hatchery versus Restoration Program, etc.). The head of any fish missing an adipose fin will be collected for CWT extraction and analysis. To limit the potential of fall-run Chinook salmon superimposing spring-run redds, redd grates may be deployed. The initial implementation of redd grates will be to determine their effectiveness at deterring superimposition. If effective, redd grates will continue to be used to protect spring-run redds. Further details are included in the attached protocol for limiting introgression and superimposition of fall-run Chinook on spring-run Chinook.

Emergence traps will be used to assess egg survival in a subsample of redds as it relates to habitat conditions over time. Fry emergence traps are tear-shaped metal structures that are higher in the center than the outside frame to accommodate the redd mound. The frame is made of steel rod, and will be either hot-dip galvanized or painted to protect against rust. A section of sheet metal on the ventral surface of the trap anchors the trap in the substrate. The cover of the trap is reinforced polyvinyl chloride (PVC) netting with a fine mesh is positioned at the front of the trap. A reinforced PVC apron around the structure will be buried into the substrate to prevent lateral fry movement. When the trap is removed, the apron will be slowly pulled from the substrate to minimize disturbance. All work will be done by hand and with hand tools. The locations for emergence traps will be dependent on the locations of natural redds.

5. 3 Juvenile Monitoring

Counts of juvenile relative abundance will be assessed through the use of rotary screw traps (RSTs) or other trapping methods. A RST consists of a 5 to 8 ft. diameter cone with interior baffles used to trap and transfer fish to a live trap supported by pontoons. The RST will be positioned within the river's thalweg in order to catch the maximum amount of flow and out-migrating juvenile salmon. Juvenile Chinook salmon will be sampled in Reaches 1 and 2 of the Restoration Area, with RSTs placed in locations during near-term monitoring, as well as downstream locations to evaluate survival through the Restoration Area. RSTs will be installed in the following general areas: near the SR 99 Bridge, just downstream of the San Mateo Road crossing, and yet-to-be-determined locations above the Merced River confluence in Reach 5. Once established, RST site locations will remain fixed each year unless changes in river conditions warrant the need to move them or if new RST sites are considered necessary for long-term study purposes.

Intentional Lethal Take:

CVSR Chinook salmon may be sacrificed for the purposes of:
1. Pathology testing prior to incorporating fish into the hatchery facilities [70 per SJR collection (280 annually), 70 per Butte Creek collection (210 annually), and 70 total for FRFH transfer];
2. Pathology testing prior to releasing fish (up to 20 fish per rearing system (80 fish annually) ;
3. CWT depth setting testing (machine per day (up to 1,000 annually) ;
4. Genetic analysis of emergent fry from SJR emergence trapping (600 annually); and,
5. Pathology testing at the hatchery (up to 60 fish annually for Facility Health Certification, and 6 fish per epizootic event in the hatchery facilities (up to 1,000 annually).

Note that in most cases the sacrificed fish would be broodstock in excess of target reproduction

Anticipated Effects on Animals:

Possible adverse effects to the collected eggs may occur in the transport process, including ionic and respiratory disturbance of the egg membrane, the spread of disease to other eggs, injury due to jostling, or death if the membrane is ruptured or punctured (CDFW 2010, Thedinga et al. 2005). The transfer and holding of fish may cause adverse effects to juveniles including stress, injury and mortality. Juveniles can easily become stressed if the ionic balance, pH, dissolved oxygen concentration, or the water temperature in the transfer tank differs greatly from the source water (NMFS 2003). Also, a high density of juvenile salmonids could elicit a stress response (increased cortisol levels) in individual fish, leading to reduced fitness, vulnerability to additional stressors, and possible mortality (Barton et al. 1980, Portz et al. 2006). It is possible that various pathogens from the donor stocks may be introduced to the rearing facility and cause disease in the other introduced stocks. Listed fish will be measured and weighed, marked with adipose fin-clips, CWT, PIT tags, and tissue may be collected for genetic analysis. All measuring and marking activities will require netting, removal and handling, these activities may induce stress or result in the removal of beneficial mucous lining, scale loss, or cause damage to fins.

Measures to Minimize Effects:

The SJRRP will seek to minimize adverse effects to the ESU and individuals by limiting the number of fish collected based on the current donor stock status, minimize additional handling by relying on existing sampling activities when possible, and by using appropriate methods to minimize stress and mortality.

Operating guidelines for all hatchery facilities will be based on widely accepted best management practices. These will include, but are not limited to: maintenance of water quality discharges to those set forth in any hatchery discharge permit and equipment associated with the holding tanks will be properly maintained. Health inspection data for IHNV and BKD are collected from ovarian fluid of returning adult females annually during spawning. Eggs from IHNV and BKD negative females will be properly disinfected at FRFH and transported to streamside incubation near the SJR. Eggs for translocation will not be taken to the SCARF.

All eggs destined for translocation to the SJR will be transported when the eggs are the most shock resistant. Trout and salmon eggs become progressively more fragile during a period extending roughly from 48 hours after water-hardening until they are eyed. The eggs must not be moved until this critical period has passed. During the eyed stage, eggs usually are shocked, cleaned, measured, counted, and shipped (Piper et al. 1982). This is the stage between the time the eyes become visible and hatching occurs.

Eggs will be placed in a specialized shipping container (e.g. Styrofoam cooler) to reduce excessive movement and limit damage to the egg membrane. Eggs will be segregated in wet cheesecloth, then placed in the shipping container, kept cool and moist using ice, and transported in a dark environment. Ice will be in a separate compartment of the shipping container, so as not to be in direct contact with the eggs. The ideal temperature for transport is between 5 – 10 degrees Celsius (°C).

Quarantine requirements, as defined by CDFW pathologists, will be followed for juveniles. If quarantine is required, juveniles may be transported to a quarantine facility at Interim Facility, SIRF, Silverado or, CABA. If quarantine is necessary, between December and March, juveniles will be quarantined for the minimum 30-day health evaluation (see Sections 5 5.3 Quarantine and Pathology and 5.4 Quarantine Facilities). After quarantine and pathology testing, juveniles will be transported to the SJR.

Any juveniles requiring transport directly to the SJR or another facility will be moved utilizing a fish transport tank. This will usually occur between January and April. The tank will be filled with water from the starting location just prior to transport. Transport times will depend on the location, but may be as long as 6 hours. Before transferring fish, the water will be tempered to within two degrees Celsius of the water temperature at the receiving facility.

Resources Needed to Accomplish Objectives: The USFWS, Reclamation, NMFS, CDFW and California Department of Water Resources DWR organized a Program Management Team and associated Work Groups to begin work implementing the restoration of the SJR flow and the reintroduction of salmon to the river, per the terms of the Settlement. The implementing agencies have designated staff and resources to provide for the proposed action, and will continue to include such resources in the future, as the need arises. This consortium of implementing agencies has the resources needed to accomplish the activities listed in this application.

Disposition of Tissues: Salmonid tissues will include:
1. Tissues sent to pathology for fish health assessment. Tissue samples for pathology would be sent to the CDFW Fish Health Lab in Rancho Cordova, or to a USFWS Fish Health Lab;
2. Tissues for genetic analysis. Samples for genetic analysis would be sent to the, California Department of Fish and Game, Tissue Archive Lab, 1875 Alpine Avenue Suite F, Sacramento, California 95814, or to the NMFS Southwest Fisheries Science Center in Santa Cruz, CA;
3. Fish mortalities associated with fish husbandry, transport, and carcass surveys. Fish mortalities would be properly disposed of by CDFW, USFWS or USBR personnel; and,
4. Tissues for fish research such as otoliths and blood samples. Tissue samples for research will receive prior authorization from CDFW, USFWS and NMFS.

Public Availability of Product/Publications: Included in this activity are: annual Donor Stock Collection Plan, Conservation Facility Annual Report, Collection Reports, and quarterly reports. Additionally Reports from all monitoring activities will be made available on the SJRRP website (resotresjr.net).

Federal Information

Federal Agency	Type	Authorization Number and Title	Date Signed	Expiration Date	Listing Units/Stocks Covered	Comments
U.S. Fish and Wildlife Service (FWS)	Cooperator	various BOs			N/A	The SJRRP requires the cooperation of, and various funding contributions by, the National Marine Fisheries Service, the US Fish and Wildlife Service, and the Bureau of Reclamation (in addition to multiple state, local, and NGO entities.

Location/Take Information

Location

Research Area: Pacific Ocean **State:** CA **Sub Basin (4th Field HUC):** Middle San Joaquin-Lower Chowchilla **Stream Name:** San Joaquin River
Location Description: San Joaquin River Broodstock Collection

Take Information

Line	Ver	Species	Listing Unit/Stock	Production /Origin	Life Stage	Sex	Expected Take	Indirect Mort	Take Action	Observe /Collect Method	Procedure	Run	Transport Record	Begin Date	End Date
1		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Natural	Adult	Male and Female	250	0	Broodstock collection	Net, Fyke	Anesthetize; Finclip - mark; Tag, Acoustic or Sonic (Internal); Tag, Coded-Wire; Tag, Floy; Tag, PIT; Tissue Sample Fin or Opercle; Tissue Sample Otolith; Tissue Sample Scale	Spring	N/A	9/10/2018	12/31/2023
		Details: Adult weir or hand/dip net may also be used if conditions are appropriate. Fish in excess of broodstock needs may be released as ancillary broodstock. See Releases table for maximum number of ancillary broodstock (by lifestage) that may be released.													
2		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Listed Hatchery Adipose Clip	Adult	Male and Female	250	0	Broodstock collection	Net, Fyke	Tag, Acoustic or Sonic (Internal); Tag, Floy; Tag, PIT; Tissue Sample Fin or Opercle; Tissue Sample Otolith; Tissue Sample Scale	Spring	N/A	9/10/2018	12/31/2023
		Details: Adult weir or hand/dip net may also be used if conditions are appropriate. Fish in excess of broodstock needs may be released as ancillary broodstock. See Releases table for maximum number of ancillary broodstock (by lifestage) that may be released.													
3		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Natural	Juvenile	Male and Female	2700	0	Broodstock collection	Trap, Screw	Anesthetize; Finclip - mark; Tag, Acoustic or Sonic (Internal); Tag, Coded-Wire; Tag, PIT; Tissue Sample Fin or Opercle	Spring	N/A	9/10/2018	12/31/2023
		Details: Weir, Beach Seine, hand net, fyke trap, and/or fyke net may also be used if conditions are appropriate. Fish in excess of broodstock needs may be released as ancillary broodstock. See Releases table.													

4		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Natural	Juvenile	Male and Female	280	0	Intentional (Directed) Mortality	Trap, Screw	Tissue sample (other internal tissues)	Spring	N/A	9/10/2018	12/31/2023
		Details: Total number of fish for pathology - 70 per collection up to 4 collections													
5		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Natural	Fry	Unknown	400	0	Broodstock collection	Trap, Not listed here	Anesthetize; Finclip - mark; Tag, Acoustic or Sonic (Internal); Tag, PIT; Tissue Sample Fin or Opercle	Spring	N/A	9/10/2018	12/31/2023
		Details: Emergence Traps. Fish in excess of broodstock needs may be released as ancillary broodstock. See Releases table for maximum number of ancillary broodstock (by lifestage) that may be released.													
6		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Natural	Fry	Unknown	600	0	Intentional (Directed) Mortality	Trap, Not listed here	Tissue Sample Fin or Opercle	Spring	N/A	9/10/2018	12/31/2023
		Details: Emergence Trap - Genetic Sampling													
7		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Natural	Egg	Unknown	1000	0	Broodstock collection	Trap, Not listed here	Anesthetize; Finclip - mark; Tag, Acoustic or Sonic (Internal); Tag, Coded-Wire; Tag, PIT; Tissue Sample Fin or Opercle	Spring	N/A	9/10/2018	12/31/2023
		Details: Egg extraction from redds by excavation or egg pumping. Fish in excess of broodstock needs may be released as ancillary broodstock. See Releases table for maximum number of ancillary broodstock (by lifestage) that may be released.													

Location

Research Area: Pacific Ocean **State:** CA **Sub Basin (4th Field HUC):** Middle San Joaquin-Lower Chowchilla **Stream Name:** San Joaquin River
Location Description: Juvenile Production Releases and Releases of Ancillary Broodstock

Take Information

Line	Ver	Species	Listing Unit/Stock	Production /Origin	Life Stage	Sex	Expected Take	Indirect Mort	Take Action	Observe /Collect Method	Procedure	Run	Transport Record	Begin Date	End Date

1		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Listed Hatchery Intact Adipose	Egg	Unknown	2080000	832000	Juvenile Releases	Hand and/or Dip Net	Anesthetize; Dye Injection (tattoo, photonic); Finclip - mark; Paint, Stain or Dye Immersion; Tag, Acoustic or Sonic (Internal); Tag, Coded-Wire; Tag, PIT; Tissue Sample Fin or Opercle	Spring	N/A	9/10/2018	12/31/2023
		Details: Indirect Mortality: Based on average survival from egg to release during recent years (avg: approx. 60%). Up to 10% of releases may be yearling (1+) age juveniles													
2		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Listed Hatchery Adipose Clip	Juvenile	Male and Female	320	0	Intentional (Directed) Mortality	Hand and/or Dip Net	Tissue sample (other internal tissues)	Spring	N/A	9/10/2018	12/31/2023
		Details: Pre-release health assessment, 20 fish per release group up to 16 release groups													
3		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Listed Hatchery Intact Adipose	Egg	Unknown	80000	38823	Juvenile Releases	Hand and/or Dip Net	Anesthetize; Dye Injection (tattoo, photonic); Finclip - mark; Paint, Stain or Dye Immersion; Tag, Acoustic or Sonic (Internal); Tag, Coded-Wire; Tag, PIT; Tissue Sample Fin or Opercle	Spring	N/A	9/10/2018	12/31/2023
		Details: Eggs from Feather River Fish Hatchery that are translocated, reared, and released as juveniles into the San Joaquin River. Indirect mortality is estimated from egg to size at release.													
4		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Listed Hatchery Adipose Clip	Juvenile	Male and Female	100	0	Intentional (Directed) Mortality	Hand and/or Dip Net	Tissue sample (other internal tissues)	Spring	N/A	9/10/2018	12/31/2023
		Details: Pre-release health assessment for fish from Feather River Fish Hatchery													
5		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Listed Hatchery Adipose Clip	Juvenile	Male and Female	2500	75	Collect, Sample, and Transport Live Animal	Hand and/or Dip Net	Anesthetize; Tag, Acoustic or Sonic (External); Tag, Acoustic or Sonic (Internal); Tag, Floy; Tag, PIT; Tissue Sample Fin or Opercle	Spring	4;5	9/10/2018	12/31/2023
		Details: Release of ancillary broodstock into river at age-0 or age-1													

6		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Listed Hatchery Adipose Clip	Juvenile	Male and Female	100	0	Intentional (Directed) Mortality	Hand and/or Dip Net	Tissue sample (other internal tissues)	Spring	N/A	9/10/2018	12/31/2023
		Details: Pre-release health screening of age-0 or age-1 ancillary broodstock													
7		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Listed Hatchery Adipose Clip	Adult	Male and Female	2500	75	Collect, Sample, and Transport Live Animal	Hand and/or Dip Net	Anesthetize; Tag, Acoustic or Sonic (External); Tag, Acoustic or Sonic (Internal); Tag, Floy; Tag, PIT; Tissue Sample Fin or Opercle	Spring	5	9/10/2018	12/31/2023
		Details: Release of adult ancillary broodstock													
8		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Listed Hatchery Adipose Clip	Adult	Male and Female	25	0	Intentional (Directed) Mortality	Hand and/or Dip Net	Tissue sample (other internal tissues)	Spring	N/A	9/10/2018	12/31/2023
		Details: Pre-release health screening of adult ancillary broodstock													
9		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Listed Hatchery Adipose Clip	Juvenile	Male and Female	1000	0	Intentional (Directed) Mortality	Hand and/or Dip Net	Tag, Coded-Wire	Spring	N/A	9/10/2018	12/31/2023
		Details: Sacrificed as part of CWT process to set correct tag depth. This could include up to 25 fish per day that were taken as broodstock from any of the sources (Butte, FRFH, or SJR).													

Location

Research Area: Pacific Ocean **State:** CA **Sub Basin (4th Field HUC):** Middle San Joaquin-Lower Chowchilla **Stream Name:** San Joaquin River from Friant Dam downstream to confluence with Merced River

Location Description: Research, Monitoring, and Evaluation Activities conducted in the San Joaquin River

Take Information

Line	Ver	Species	Listing Unit/Stock	Production /Origin	Life Stage	Sex	Expected Take	Indirect Mort	Take Action	Observe /Collect Method	Procedure	Run	Transport Record	Begin Date	End Date

1		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Natural	Adult	Male and Female	2500	50	Collect, Sample, and Transport Live Animal	Hand and/or Dip Net	Anesthetize; Tag, Acoustic or Sonic (External); Tag, Acoustic or Sonic (Internal); Tag, Floy; Tag, PIT; Tissue Sample Fin or Opercle; Tissue Sample Scale	Spring	3	9/10/2018	12/31/2023
		Details: We will survey barriers, sloughs, and backwater areas for any fish that get past the trap and collect with dip nets. Capture and transport of returning adults to spawning grounds. Disc tags may be used instead of floy tags.													
2		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Listed Hatchery Adipose Clip	Adult	Male and Female	2500	50	Collect, Sample, and Transport Live Animal	Hand and/or Dip Net	Anesthetize; Tag, Acoustic or Sonic (External); Tag, Acoustic or Sonic (Internal); Tag, Floy; Tag, PIT; Tissue Sample Fin or Opercle; Tissue Sample Scale	Spring	3	9/10/2018	12/31/2023
		Details: We will survey barriers, sloughs, and backwater areas for any fish that get past the trap and collect with dip nets. Capture and transport of returning adults to spawning grounds. Disc tags may be used instead of floy tags.													
3		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Natural	Adult	Male and Female	2500	0	Observe/Harass	Snorkel/Dive surveys		Spring	N/A	9/10/2018	12/31/2023
		Details: Snorkel/visual observation of adult fish in upper reaches of San Joaquin River													

4		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Listed Hatchery Adipose Clip	Adult	Male and Female	2500	0	Observe/Harass	Snorkel/Dive surveys		Spring	N/A	9/10/2018	12/31/2023
		Details: Snorkel/visual observation of adult fish in upper reaches of San Joaquin River													
5		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Natural	Adult	Male and Female	2500	0	Observe/Sample Tissue Dead Animal	Spawning surveys	Finclip - mark; Tag, Floy; Tissue sample (other internal tissues); Tissue Sample Fin or Opercle; Tissue Sample Otolith; Tissue Sample Scale	Spring	N/A	9/10/2018	12/31/2023
		Details: Carcass surveys by boat and foot. Hog ring external tags may be used.													
6		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Listed Hatchery Adipose Clip	Adult	Male and Female	2500	0	Observe/Sample Tissue Dead Animal	Spawning surveys	Finclip - mark; Tag, Floy; Tissue sample (other internal tissues); Tissue Sample Fin or Opercle; Tissue Sample Otolith; Tissue Sample Scale	Spring	N/A	9/10/2018	12/31/2023
		Details: Carcass surveys by boat and foot. Hog ring external tags may be used.													
7		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Natural	Adult	Male and Female	2500	0	Observe/Harass	Observations at weirs, fish ladders, dams where no trapping occurs		Spring	N/A	9/10/2018	12/31/2023
		Details: Monitoring for returning adults with a weir and VAKI camera unit													

8		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Listed Hatchery Adipose Clip	Adult	Male and Female	2500	0	Observe/Harass	Observations at weirs, fish ladders, dams where no trapping occurs		Spring	N/A	9/10/2018	12/31/2023
		Details: Monitoring for returning adults with a weir and VAKI camera unit													
9		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Natural	Adult	Male and Female	2500	50	Collect, Sample, and Transport Live Animal	Net, Fyke	Tag, Acoustic or Sonic (External); Tag, Acoustic or Sonic (Internal); Tag, Floy; Tag, PIT; Tissue Sample Fin or Opercle; Tissue Sample Scale	Spring	3	9/10/2018	12/31/2023
		Details: Capture and transport of returning adults to spawning grounds. Fish will only be transported if necessary. Disc tags may be used instead of floy tags. Additional capture methods (adult weir, seine, fyke trap, hand net) may be used													
10		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Listed Hatchery Adipose Clip	Adult	Male and Female	2500	50	Collect, Sample, and Transport Live Animal	Net, Fyke	Tag, Acoustic or Sonic (External); Tag, Acoustic or Sonic (Internal); Tag, Floy; Tag, PIT; Tissue Sample Fin or Opercle; Tissue Sample Scale	Spring	3	9/10/2018	12/31/2023
		Details: Capture and transport of returning adults to spawning grounds. Fish will only be transported if necessary. Disc tags may be used instead of floy tags. Additional capture methods (adult weir, seine, fyke trap, hand net) may be used													
		Salmon,	Central Valley			Male and			Capture/Mark, Tag,		Anesthetize; Dye Injection (tattoo, photonic); Tag,				

11		Chinook	spring-run (NMFS Threatened)	Natural	Juvenile	Female	120000	2400	Sample Tissue/Release Live Animal	Trap, Screw	PIT; Tissue Sample Fin or Opercle; Tissue Sample Scale	Spring	N/A	9/10/2018	12/31/2023
		Details: Fyke net sampling will also be used. Fish will be counted measured and released. A subset may be used for RST efficiency trials. Fin clips may also be taken from a subset of individuals for genetic analysis.													
12		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Listed Hatchery Adipose Clip	Juvenile	Male and Female	120000	2400	Capture/Mark, Tag, Sample Tissue/Release Live Animal	Trap, Screw	Anesthetize; Dye Injection (tattoo, photonic); Tag, PIT; Tissue Sample Fin or Opercle; Tissue Sample Scale	Spring	N/A	9/10/2018	12/31/2023
		Details: Fyke net sampling will also be used. Fish will be counted measured and released. A subset may be used for RST efficiency trials. Fin clips may also be taken from a subset of individuals for genetic analysis.													
13		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Natural	Juvenile	Male and Female	750000	15000	Capture/Mark, Tag, Sample Tissue/Release Live Animal	Weir (only if associated with fish handling)	Anesthetize; Dye Injection (tattoo, photonic); Finclip - mark; Tag, PIT; Tissue Sample Fin or Opercle; Tissue Sample Scale	Spring	N/A	9/10/2018	12/31/2023
		Details: This effort will be to assist fish with emigrating out of the system due to unfavorable river conditions such as no flow connectivity in low water years. Juveniles will be collected in the weir then transported to more suitable habitat.													
14		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Natural	Fry	Unknown	60000	6000	Capture/Handle/Release Fish	Trap, Not listed here		Spring	N/A	9/10/2018	12/31/2023
		Details: Emergence trap for redds. Assumes 20 redds and up to 3000 fry per redd. A subset of the fry that are collected will be measured and released. Assumes a 10% total mortality rate.													

15		Steelhead	California Central Valley (NMFS Threatened)	Natural	Adult	Male and Female	50	2	Capture/Handle/Release Fish	Net, Fyke		N/A	N/A	9/10/2018	12/31/2023
		Details: Incidental capture of steelhead while targeting Chinook salmon													
16		Steelhead	California Central Valley (NMFS Threatened)	Listed Hatchery Adipose Clip	Adult	Male and Female	50	2	Capture/Handle/Release Fish	Net, Fyke		N/A	N/A	9/10/2018	12/31/2023
		Details: Incidental capture of steelhead while targeting Chinook salmon													
17		Steelhead	California Central Valley (NMFS Threatened)	Natural	Adult	Male and Female	50	0	Observe/Harass	Snorkel/Dive surveys		N/A	N/A	9/10/2018	12/31/2023
		Details: Snorkel/visual observation of adult fish in the upper reaches of San Joaquin River. Target is Chinook salmon, but observations of steelhead will be recorded													
18		Steelhead	California Central Valley (NMFS Threatened)	Listed Hatchery Adipose Clip	Adult	Male and Female	50	0	Observe/Harass	Snorkel/Dive surveys		N/A	N/A	9/10/2018	12/31/2023
		Details: Snorkel/visual observation of adult fish in the upper reaches of San Joaquin River. Target is Chinook salmon, but observations of steelhead will be recorded													
19		Steelhead	California Central Valley (NMFS Threatened)	Natural	Adult	Male and Female	50	2	Capture/Mark, Tag, Sample Tissue/Release Live Animal	Hand and/or Dip Net	Anesthetize; Tag, Floy; Tag, PIT; Tissue Sample Fin or Opercle; Tissue Sample Scale	N/A	N/A	9/10/2018	12/31/2023
		Details: Incidental encounters while surveying for Chinook salmon at barriers, sloughs and backwater areas. Any steelhead encountered will be transported under a different permit (16608-2R)													
20		Steelhead	California Central Valley (NMFS	Listed Hatchery Adipose	Adult	Male and Female	50	2	Capture/Mark, Tag, Sample Tissue/Release Live Animal	Hand and/or Dip Net	Anesthetize; Tag, Floy; Tag, PIT; Tissue Sample Fin or	N/A	N/A	9/10/2018	12/31/2023

			(NMFS Threatened)	Clip					Live Animal		Opercle; Tissue Sample Scale				
	Details: Incidental encounters while surveying for Chinook salmon at barriers, sloughs and backwater areas. Any steelhead encountered will be transported under a different permit (16608-2R)														
21		Steelhead	California Central Valley (NMFS Threatened)	Natural	Adult	Male and Female	100	0	Observe/Harass	Observations at weirs, fish ladders, dams where no trapping occurs		N/A	N/A	9/10/2018	12/31/2023
	Details: Monitoring for returning adults with a weir and VAKI camera unit														
22		Steelhead	California Central Valley (NMFS Threatened)	Natural	Juvenile	Male and Female	100	2	Capture/Mark, Tag, Sample Tissue/Release Live Animal	Trap, Screw	Anesthetize; Tag, Floy; Tag, PIT	N/A	N/A	9/10/2018	12/31/2023
	Details: Potential incidental capture of steelhead in rotary screw traps targeting Chinook salmon. Fyke net sampling may also be used.														
23		Steelhead	California Central Valley (NMFS Threatened)	Natural	Juvenile	Male and Female	100	2	Capture/Handle/Release Fish	Weir (only if associated with fish handling)		N/A	N/A	9/10/2018	12/31/2023
	Details: Steelhead incidentally caught during this effort will be released back to the river for continued rearing until the following spring.														

Location

Research Area: Pacific Ocean **State:** CA **Stream Name:** Feather River and Butte Creek
Location Description: Source Stock Collections from Feather River Fish Hatchery and Butte Creek

Take Information

Line	Ver	Species	Listing Unit/Stock	Production /Origin	Life Stage	Sex	Expected Take	Indirect Mort	Take Action	Observe /Collect Method	Procedure	Run	Transport Record	Begin Date	End Date
1		Salmon, Chinook	Central Valley spring-run (NMFS	Listed Hatchery Intact	Egg	Unknown	5470	0	Collect, Sample, and Transport	Hand and/or Dip Net	Anesthetize; Finclip - mark; Tag, Acoustic or Sonic (Internal); Tag, Coded-Wire; Tag, Floy;	Spring	2	9/10/2018	12/31/2023

			Threatened)	Adipose					Live Animal	Dip Net	Tag, PIT; Tissue Sample Fin or Opercle				
		Details: FRFH: Eggs collected for broodstock and reared to adult lifestage at SCARF or iSCARF													
2		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Listed Hatchery Intact Adipose	Juvenile	Male and Female	70	0	Intentional (Directed) Mortality	Hand and/or Dip Net	Tissue sample (other internal tissues)	Spring	N/A	9/10/2018	12/31/2023
		Details: FRFH: Pathology testing for broodstock health prior to transfer to SCARF or iSCARF													
3		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Natural	Juvenile	Male and Female	2700	0	Collect, Sample, and Transport Live Animal	Trap, Screw	Anesthetize; Finclip - mark; Tag, Acoustic or Sonic (Internal); Tag, Coded-Wire; Tag, Floy; Tag, PIT; Tissue Sample Fin or Opercle	Spring	6	9/10/2018	12/31/2023
		Details: BUTTE CREEK: May also collect juveniles via diversion trap. Juveniles reared to adult lifestage at SCARF or iSCARF.													
4		Salmon, Chinook	Central Valley spring-run (NMFS Threatened)	Natural	Juvenile	Male and Female	210	0	Intentional (Directed) Mortality	Hand and/or Dip Net	Tissue sample (other internal tissues)	Spring	N/A	9/10/2018	12/31/2023
		Details: BUTTE CREEK: Pathology testing for broodstock health assessment prior to transfer to the SCARF or iSCARF													

Transport Information

2.

Mode(s) of Transportation: A standard vehicle will be used to transport eggs.

Transportation Company: SJRRP fisheries biologists (CDFW, USFWS, and Reclamation) have thousands of miles of experience transporting salmonids.

Maximum amount of time between capture and arrival: After quarantine, transport of eggs should occur between the eyed stage and several days prior to hatching.

Container Description: Specialized shipping container (e.g., Styrofoam cooler) to reduce excessive movement and limit damage to the egg membrane.

Special Care: The ideal temperature for transport is between 5 – 10 degrees Celsius (°C).

Accompanying Personnel Qualifications: SJRRP fish biologists have years of experience evaluating fish health, and quarantine facilities are similarly staffed with qualified individuals.

Facility Title: Interim Facility/SCARF

Facility Affiliation/Organization:

Address: Friant, CA 93626 UNITED STATES

Phone Number:

	Containment Method:	Eggs will be segregated in wet cheesecloth, then placed in the shipping container. Ice will be in a separate compartment of the shipping container, so as not to be in direct contact with the eggs.
	Final Disposition:	Eggs will be transferred to SIRF or similar streamside incubation facility.
3.	**Mode(s) of Transportation:**	Fish transport tanks
	Transportation Company:	SJRRP fisheries biologists (CDFW, USFWS, and Reclamation) have thousands of miles of experience transporting salmonids.
	Maximum amount of time between capture and arrival:	Transport times will depend on the location, but may be as long as 6 hours.
	Container Description:	300 or 500-gallon insulated fish transport tank. River water near the capture site will be used along with salt (NaCl) added to minimize stress. Oxygen is supplied via micro-bubble diffusers to maintain DO levels.
	Special Care:	Before transferring fish, the water would be tempered to within 2°C of the water temperature at the receiving facility
	Accompanying Personnel Qualifications:	SJRRP fish biologists have years of experience evaluating fish health, and quarantine facilities are similarly staffed with qualified individuals.
	Facility Title:	San Joaquin River
	Facility Affiliation/Organization:	
	Address:	Fresno, CA UNITED STATES
	Phone Number:	
	Containment Method:	holding tank (size commensurate with life stage and density)
	Final Disposition:	Either transported to the upper Reaches of the Restoration Area where there is suitable spawning habitat, held in in-river net pens, or transferred to a holding facility
4.	**Mode(s) of Transportation:**	Fish transport tanks
	Transportation Company:	SJRRP fisheries biologists (CDFW, USFWS, and Reclamation) have thousands of miles of experience transporting salmonids.
	Maximum amount of time between capture and arrival:	Transport times will depend on the location, but may be as long as 6 hours.
	Container Description:	300 or 500-gallon insulated fish transport tank. River water near the capture site will be used along with salt (NaCl) added to minimize stress. Oxygen is supplied via micro-bubble diffusers to maintain DO levels.
	Special Care:	Visual inspections of fish and water quality will be made during transport to release site. A holding time necessary to temper at rate not greater than of 1C/hour but and not more than 5 C/day
	Accompanying Personnel Qualifications:	SJRRP fish biologists have years of experience evaluating fish health, and quarantine facilities are similarly staffed
	Facility Title:	San Joaquin River, between Friant Dam and Confluence of Merced River
	Facility Affiliation/Organization:	

	Address:	Fresno, CA UNITED STATES
	Phone Number:	
	Containment Method:	Fish will be netted from holding tanks at the hatchery facility and transferred to an appropriate sized fish transport tank outfitted with diffused oxygen and/or aerators, and water from fish source.
	Final Disposition:	Trucked downstream to be released at predetermined locations along the SJR where they can migrate out of system. Fish release sites will be based on having suitable water quality conditions and proximity to migration obstacles.
5.	**Mode(s) of Transportation:**	Fish transport tanks
	Transportation Company:	SJRRP fisheries biologists (CDFW, USFWS, and Reclamation) have thousands of miles of experience transporting salmonids.
	Maximum amount of time between capture and arrival:	Transport times will depend on the location, but may be as long as 6 hours.
	Container Description:	300 or 500-gallon insulated fish transport tank. River water near the capture site will be used along with salt (NaCl) added to minimize stress. Oxygen is supplied via micro-bubble diffusers to maintain DO levels.
	Special Care:	Visual inspections of fish and water quality will be made during transport to release site. A holding time necessary to temper at rate not greater than of 1C/hour but and not more than 5 C/day
	Accompanying Personnel Qualifications:	SJRRP fish biologists have years of experience evaluating fish health, and quarantine facilities are similarly staffed with qualified individuals.
	Facility Title:	San Joaquin River
	Facility Affiliation/Organization:	
	Address:	Fresno, CA UNITED STATES
	Phone Number:	
	Containment Method:	water-to-water transfer or released directly from the tank using a pipe or shoot. Direct netting of fish.
	Final Disposition:	Incorporating Captive Reared Adults into Spawning Population.
6.	**Mode(s) of Transportation:**	Fish transport tanks
	Transportation Company:	SJRRP fisheries biologists (CDFW, USFWS, and Reclamation) have thousands of miles of experience transporting salmonids.
	Maximum amount of time between capture and arrival:	Transport times will depend on location of collection, but should be less than 3 hours
	Container Description:	300 or 500-gallon insulated fish transport tank. River water near the capture site will be used along with salt (NaCl) added to minimize stress. Oxygen is supplied via micro-bubble diffusers to maintain DO levels.
	Special Care:	Before transferring fish, the water would be tempered to within 2°C of the water temperature at the receiving facility
	Accompanying Personnel Qualifications:	SJRRP fish biologists have years of experience evaluating fish health, and quarantine facilities are similarly staffed with qualified individuals
	Facility Title:	Interim Facility/SCARF

Facility Affiliation/Organization:
Address: Friant, CA 93626 UNITED STATES
Phone Number:
Containment Method: holding tank (size commensurate with life stage and density)
Final Disposition: Following quarantine/rearing, fish will become broodstock and the SJRRP hatchery facilities.

Project Contacts

Responsible Party: Donald Ratcliff
Primary Contact: Kimberly Clements
Principal Investigator: Lori Smith

Other Personnel

Name	Role(s)
Paul Adelizi	Co-Investigator
Adriana Arrambide	Co-Investigator
Michael Bandy	Co-Investigator
Matt Bigelow	Co-Investigator
Paul Carrillo	Co-Investigator
Eric Chapman	Co-Investigator
Patrick Ferguson	Co-Investigator
Michael Ficele	Co-Investigator
Emily Flink	Co-Investigator
Clarence Fullard	Co-Investigator
Jeff Gartner	Co-Investigator
Mike Grill	Co-Investigator
Thomas Gromis	Co-Investigator
Charles Hueth	Co-Investigator
Anna Kastner	Co-Investigator
Michaela Lowe	Co-Investigator
Ryan McKenzie	Co-Investigator
Grant McNealy	Co-Investigator

Erica M. Meyers	Co-Investigator
Rebecca Orta	Co-Investigator
Christina R Perez	Co-Investigator
Hieu Pham	Co-Investigator
Donald E Portz	Co-Investigator
Karena Potter	Co-Investigator
Michael Quiring	Co-Investigator
Shaun Root	Co-Investigator
Andy Shriver	Co-Investigator
Gabe Singer	Co-Investigator
Zachary Sutphin	Co-Investigator
Louis Trojan	Co-Investigator
Alec Villanueva	Co-Investigator
Daniel Whittington	Co-Investigator
Stephen Winsor	Co-Investigator

Attachments

Certification of Identity - (Added Jun 9, 2017)
Contact - Adriana Arrambide (Added Mar 9, 2018)
Contact - Alec Villanueva (Added Mar 9, 2018)
Contact - Andy Shriver (Added Feb 3, 2015)
Contact - Anna Kastner (Added Oct 24, 2013)
Contact - Charles Hueth (Added Aug 26, 2016)
Contact - Christina R Perez (Added Jan 13, 2017)
Contact - Clarence Fullard (Added Dec 16, 2016)
Contact - Daniel Whittington (Added Mar 9, 2018)
Contact - Donald E Portz (Added Aug 29, 2016)
Contact - Donald Ratcliff (Added Apr 24, 2015)
Contact - Emily Flink (Added Mar 9, 2018)
Contact - Eric Chapman (Added Aug 10, 2018)
Contact - Erica M. Meyers (Added Oct 9, 2015)
Contact - Gabe Singer (Added Dec 5, 2016)
Contact - Gabe Singer (Added Aug 24, 2017)
Contact - Grant McNealy (Added Mar 9, 2018)
Contact - Hieu Pham (Added Mar 9, 2018)
Contact - Jeff Gartner (Added Mar 9, 2018)

Contact - Karena Potter (Added Jan 13, 2017)
Contact - Lori Smith (Added May 14, 2010)
Contact - Louis Trojan (Added Jan 13, 2017)
Contact - Matt Bigelow (Added Sep 15, 2010)
Contact - Michael Bandy (Added Jan 13, 2017)
Contact - Michael Ficele (Added Apr 2, 2013)
Contact - Michael Quiring (Added Mar 9, 2018)
Contact - Michaela Lowe (Added Jan 13, 2017)
Contact - Mike Grill (Added Sep 29, 2015)
Contact - Patrick Ferguson (Added Oct 24, 2013)
Contact - Paul Adelizi (Added Apr 2, 2013)
Contact - Paul Carrillo (Added Mar 9, 2018)
Contact - Rebecca Orta (Added Mar 9, 2018)
Contact - Ryan McKenzie (Added Mar 9, 2018)
Contact - Shaun Root (Added Oct 5, 2015)
Contact - Stephen Winsor (Added Mar 9, 2018)
Contact - Thomas Gromis (Added Sep 29, 2015)
Contact - Zachary Sutphin (Added Aug 26, 2016)
Project Description - (Added Sep 6, 2017)
References - (Added Jun 8, 2017)

Status

Application Status: Application Complete
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Last Date Archived: September 11, 2018

- **ESA Section 10(a)(1)(A) permit (Salmonid hatchery)**

  Current Status: Issued **Status Date:** September 10, 2018
  Section 7 Consultation: Formal Consultation
  NEPA Analysis: Environmental Assessment
  Expire Date: December 31, 2023

Analyst Information:

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Reports